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FEBRUARY 1976
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73 amateur radio

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Say, fine print readers, 73 is growing rapidly and sure could use a couple more active hams who are technically ept and maybe can write. You won't find a much more fun place to work . . . and money isn't everything, right?

#184 FEB 1976

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EDITORIAL BY WAYNE GREEN

ANY PUBLICITY IS GOOD PUBLICITY

So the saying goes, anyway . . . just be sure to spell my name right. Apropos of the bum dope spread by jealous competitors re the bonus November/December issue of *73*, which 256-pager came as a terrible shock to other publishers . . . heh, heh.

One club bulletin editor and two readers got so unnerved over the reported rip-off by *73* that they wrote about it. The only rip-off was the spurious report that subscribers might get only eleven issues for the year.

When it became obvious that nothing was going to stop ARRL in its madness in going to the larger format for *QST* . . . and that their satellite was also going to make the change, we said what the hell, it makes no sense from any standpoint, but if that's the size ads are going to be, then *73* has to fit the ads or else *73* is out of biz. Okay, as long as we're going to change size, why not get the jump on our slower compatriots and come out in December with the first large magazine and drive them crazy.

The first plan was to have the November and December issues of *73* on their regular schedule and at the old size, but come out with a special bonus issue in between the other two in the large size . . . a "Shape of Things to Come" issue. The ad department started selling the idea to advertisers and before long we found ourselves way over our heads in magazine. Our staff had more work than they could handle, with three big issues coming out at two week intervals. My solution to the jam-up was to put the November and December issues together and make that one issue. This would fill out the binders with the old smaller size magazine. The "Shape" issue would then be the January issue, but would come out on the December issue schedule.

Even so, the work was enough to put the November/December issue about a week behind its schedule and the January Giant issue two weeks behind. We'll catch up in a couple of months if we don't think up any new ideas for big issues and get the ad department triggered into a selling spree again. The more ads, the bigger the magazine, obviously.

My plan to call the January issue a December/January issue just to further confuse everyone was vetoed. Spoil sports.

WHERE COMPUTERS ARE AT

Those readers of *73* who are into microcomputers are in on the ground floor of something new and exciting. I don't think many people realize how incredibly new the low cost computer field actually is . . . in point of fact it just got started in 1975 with the introduction of the MITS Altair 8800 processor.

By way of comparison, a computer system which might have cost $1,000,000 in 1970 was down to about $100,000 by 1974 by virtue of the application of ICs to computers. These medium priced systems were called minicomputers . . . they were mini in size, but their capability wasn't much different from most of the earlier maxis. Then came the computers-on-a-chip . . . the Intel 4004, the National IMP-16, the Intel 8008, the 4040 . . . and finally the Intel 8080. Motorola came up with the M6800, Fairchild with the F8, National with their PACE, General Instrument with a C1600, and MOS Technology with the 6501.

The micro chips revolutionized the computer industry again, resulting in the microcomputer or microprocessor, as it is often called. As with the mini, only the name and size had changed . . . the job these micros could handle were about the same as the bigger computers . . . but now the price for a system had dropped from $100,000 to about $10,000.

Have we reached the end of this progression? Not by any means. The chip people are still busily at it, designing cheaper and cheaper microprocessors . . . the latest is the $25 6501 chip which is a direct replacement for the much more expensive M6800 . . . and, as engineering costs are amortized, we can look for these costs to drop further.

The cost of peripherals will also drop as firms gear up for mass production of interface and control chips which will replace the IC-laden circuit boards of today. One-chip video display generators will probably bring the cost of the video keyboard down to the $100 range . . . like a black and white television . . . though that may take three or four years. Right now anyone that comes out with a $400 video keyboard will make millions of dollars . . . until the $350 unit comes out.

None of the present day tape storage systems are ideal for small computer systems and the race is on to invent a mass memory storage system which is geared to the low cost computer. Small businesses and homes don't need very large storage systems, nor do they need lightning fast service, so a tape system which would allow you to get your data in a few seconds would cut the mustard . . . a good trade off against price.

There are fantastic opportunities in the small computer market for making large gobs of money. There will probably be more computers sold in the next year than there are in existence in the world today . . . and maybe five to ten times that many in the next year. The hobbyist of today who gets to know the field and is able to take advantage of what he knows could be the mogul of tomorrow.

By way of getting used to how early we are in the field, as of late summer 1975, to my knowledge, even MITS had not yet started shipping complete computer systems with floppy disk operating units . . . they were close to it. Remember that MITS, as of this date, was the *only* supplier of micro systems in the country. Several others were about ready to go. By the time this reaches print I expect that there will be at least three, perhaps four, firms supplying operating microcomputer systems . . . hopefully with working floppy disk memories. Floppies will have to hold until one of the mentioned tape systems is invented. Floppies are okay . . . a little limited in capacity . . . and expensive by hobby standards . . . $1000 to $2000 range.

HAMMING IT UP ON COMPUTERS

How will we be using computers in amateur radio? Will they further reduce the quality of contacts, making them even more mechanical than today . . . if that is possible?

I realize that it is popular to bad mouth developments such as this, but the fact is that my experience indicates that it may well be that amateur radio never had it so good. Those of us who have delved into radio Teletype communications are not unaware of the fascination that this mode holds. We also are probably aware of some of the reasons for the excitement and fun of RTTY as compared to CW and SSB.

There are some basic problems involved with radiotelephone communications to which we have given too little consideration. After spending our childhood years learning

how to talk with people we can see and hear ... getting feedback from them as we talk in the way of grunts, yesses, nods, etc., and even getting these during telephone conversations ... we are unprepared to handle the prospect of talking to someone we can neither hear nor see. We are at a loss for words ... known as mike fright in beginners ... known as incredibly boring contacts and deadly routines in older timers ... the 10-4 of the CBers ... the endless repetitions of some amateurs ... the meaningless descriptions of stations, weather, and such.

Most of your life patterns are well set by the time you are five, and that includes your ability to talk to people you can't see or hear. The result is that the brain boggles and rational conversation is virtually impossible. This may explain the difference between talking to hams in person and trying to work up anything more than an exchange of pleasantries over the air.

With RTTY we find that we have a lot more time to engage the brain and give some thought to what we are trying to say. The result is that in general our communications are a lot more interesting ... more like a series of letters being exchanged than talking. It is just possible that amateurs using computers for contact would go this route. They probably would even go one step further and keep a tape of their better efforts so they would be available during later contacts.

Just imagine what an interesting story you could work up for a contact about a recent trip ... a DXpedition ... or some good DX worked ... some adventures in putting up your tower ... stories about how a beam works ... you could put real life into your contacts.

Let's move the clock ahead and imagine a contact in 1978 ... it is not your computer working his computer, but it is something like that. You would get in touch and your screen would have the hello and a list of some things you might be interested in talking about ... perhaps a list of some things you might be interested in talking about ... perhaps a list of some stories he has on tap for you. You give an okay to the tower story and immediately your screen comes up with the tale of how he read about this tower ... got the parts to build it ... got it all together and then couldn't get it raised! Your screen, when you give the keyboard a "go" gives you a couple pictures of the chap and his friends trying to raise the tower on slow scan. Then more story when you give him another "go."

Does your friend have to sit there and wait while you do all this? No, of course not ... he has gotten the same type of stuff from your system and is busy watching the story and pictures you have on tap for him.

Won't all this take up a lot of the band? Probably not ... the chances are that hundreds of contacts will be carried on in short bursts on a single channel ... possibly with a fixed frequency receiver ... or it may come down to several fixed channels such as on FM today.

On the other hand, it might not work out like that at all ... but it could.

COMPUTERMANIA

Despite a whole lot of effort, I am still an utter neophyte in the computer field. I want to establish that before I tell you about computers. Okay?

Now that I am no longer involved with *BYTE* magazine, but still haven't lost my enthusiasm for computers and their future in Amateur Radio, I'd like to do everything I can to encourage them's as what knows to write for us'n's which wants to know ... for *73*.

Now before you start to write, you computer expert, you ... I want to lay on you a little thought ... the great unwashed of us out here don't even speak your language yet. We don't know a compiler from an assembler. Oh, we really want to know and we're looking for you to explain the whole works to us in simple terms which we can understand, not in computer jargon. Just take a look at the beautiful job Larry Kahaner has been doing in explaining the basics of digital design and you'll get the idea of what we need.

We want to know about computer design, ham applications of computers, the differences between the various systems such as the 8080 based processors, the 6800 based, PACE based, etc. Sure, we know that in the end all of them will do just about anything we want them to, but we also want to try and understand what the differences are and what these differences mean to us.

We want to know about how to use our teletype machines ... our television typewriters ... our cassette recorders ... how to interface other computer equipment and use it ... how good or bad some of the new hobby computer equipment is and what we can or can't do with it ... stuff like that.

We want to get a general idea of what the major computer languages mean, why which are used and when, which we should learn and why, and so forth. We want to have an understanding of what people mean when they refer to Fortran, to Basic, to Cobol, to RPG, to PL, and other common program languages.

We want to be able to hook up computer systems and use them ... for games ... for hamming ... perhaps for printing out the schedule of Oscar 7 or the times of possible acquisition of Oscar for active Oscarites ... moonbouncers want to know where the moon is or even have a computer point their antenna ... and who of us would not like to be able to keep track of all our ham contacts in a computer system?

We want to know where we can get programs for use in our computers, from the simpler systems such as the HP-65 on up to Altair 8800, Sphere 6800, SWTPC 6800, Godbout PACE, etc. The hobby computer field shows no sign of slowing in its growth.

So there you have it ... we need articles. Writing for *73* is simple ... double space type it with generous margins, a sketch of diagrams will do (but be very careful to include everything possible), and the best photos possible. If you have trouble with photos send the stuff here and we'll take 'em. If you have a source of PC boards for construction projects be sure to let the readers know ... if not we'll try to find one. We also like to have a negative of PC boards available for interested readers if possible.

The best part, perhaps, is that we pay and pay generously for articles. Not only are you able to share your work with others and bring them fun and happiness, you also get paid ... and you get well known, too. Ask Pete Stark and other regular *73* authors about that! If publishing will help you in your work or to get a better job, this is a good medium. Of the ham magazines which pay for material, *73* has by a wide margin the largest circulation, no matter what you may have read in the way of half-truths (well, 39.5% truths) elsewhere. You want your articles to get the widest distribution, don't you?

Get busy, then, and teach us something about computers ... and try to remember what it was like to not know computer language when you write for us.

I/O

Articles on digital techniques and microcomputers will be identified in *73* from now on (see page 52) with an I/O mark ... this means Input-Output. A computer can't do anything unless there is something feeding it input ... and there is something for it to feed output to. It seems like a nice digital type term.

Continued on page 15

ou goons don't ever proofr
l[illegible]
bu[illegible]
you ignored my comments in
I insist that you print ev

LETTERS

On Your Marker

I have been etching my own circuit boards for quite a few months now and really enjoy it.

Since my boards are for one-of-a-kind projects, I have been using Datak's dry transfer etch resist. However, there are times when a pen would be handy for large areas or long lines. I purchased an etch resist pen and was very unhappy with the results. I decided to conduct an experiment to determine the best pen for this purpose. The results are surprising. Here are the results with the best listed first and the worst listed last:

1. El Marko Permanent Marker
2. ADI Ink Marker
3. Archer Etch Resist Lacquer
4. Carter's Marks-A-Lot
5. GC Electronics etch resist pen
6. Eagle Marker

The Lacquer is not a pen but a bottle with brush, and is hard to use.

Another interesting factor is that the number 1 and 2 markers are less than half the price of the etch resist pen and are readily available in most discount stores.

Barry N. Shiffrin WB2FPG
Endicott NY

S-40 Search

I am looking for a schematic on a Hallicrafter Model S-40 receiver. Even the specs on the main power transformer would help.

Mike Turner
PO Box 85
Fletcher NC 28732

Help Clearinghouse

I note the apparent contradiction between those who are experiencing difficulty in finding assistance in obtaining an amateur license and those who are only too happy to provide this needed assistance. From this situation, the need for these two groups to get together becomes quite clear. Why not start a sort of clearinghouse of names of clubs and individuals who are willing to provide assistance? A prospective amateur would only need to call or write this clearinghouse, which would see to it that he was contacted by a local ham/club for assistance. In reality this should be a function of the ARRL, but it is quite apparent they have not fulfilled this need. This would be an ideal function for some club to provide. In the meantime, I would like to volunteer my services to function in this role. Any individual/club who is willing to serve as a helper, anywhere in the country, is welcomed to call or write me to start a list. Any potential amateurs are also welcomed to contact me and I will strive to find someone to provide assistance to you.

Dennis M. Brown WA3URT
R#1 Box 136B
Lebanon PA 17042
717-949-2316

Good Godbout!

I want to tell you about one of your advertisers . . . Bill Godbout . . . great! Some time ago I ordered some parts from him, and would you believe I got 1 week delivery? That's what I call service. You always hear about the "bad" guys – I just wanted to let you know about a "good" one.

Chuck Young WB8TDW
Waverly OH

Rich? – or Crazy?

My November/December issue arrived a few days ago and I haven't put it down since. My mouth was hanging in disbelief as I read WØSYK's account of his antenna system. It must be nice to be rich – or is it just crazy? – hi.

I also enjoyed W1BNN's article about his Germany days. I *always* enjoy the old timers' stories or any story about an unusual occurrence – particularly involving ham radio. I think it is great that *73* encourages this type of writing, as I find it a very enjoyable interlude from some of the monotonous technical articles found in some of the other mags.

Well, keep up the good stuff!

Mark Morgida WA1SSW
Billerica MA

CU on 20

I would like some information about, or to see published, an article on curing the interference from the 15 kHz sweep circuits in TV sets. This gets really strong in ham receivers on the 160 and 8 meter bands.

Also, how about an article on how to build a battery-operated QRM locator, using loop antenna (omni-directional), with meter, so a person could go directly to the noise source? Have *73* from the first issue, and always enjoy it. CU on 20.

Glenn Lay W7ADS
Yakima WA

At the Forefront

I'm grateful to *73 Magazine* for being 100% behind its products. I had some trouble with a 20 wpm code tape, wrote and requested that it be replaced, and two weeks later I received a replacement.

Services such as this will keep *73 Magazine* at the forefront. Thank you.

Jeffry M. Blackmon WB2UYI
North Tonawanda NY

HP-45 Fun (Cont.)

I am writing in regard to another letter which appeared in the Letters column of the October issue of *73*. It is entitled HP-45 Fun from Sig Peterson III of Portland, Oregon.

The time indicated by the HP-45 is NOT accurate. On the HP-45 I own, the timer indicates 52 seconds after 60 seconds have elapsed. This has been verified by checking against several different clocks, both electrically timed by the generators and by quartz crystals (which are in use here on the radar site), and by checking with WWVH.

This has presented no major problem as the 8 second error is constant and, as long as I can remember the error, I have been able to use my HP-45 as an elapsed time indicator.

There is another set of presets which do the same thing. They are as follows:

1. Press the "RCL" button.
2. Simultaneously press 3 keys: "R ↓ ", "STO", and "CHS". After obtaining the display as shown in Mr. Peterson's letter, the remainder of the operations are the same as shown in the letter.

As I work with several engineering types here in the radio shop, and the White Alice Communications System section, I was able to borrow an HP-35 and an HP-55 to try these programs on. Neither of the other calculators will duplicate the function.

The HP-XX series of calculators are

Continued on page 74

be my guest

visiting views from around the world

The Time Has Come

The expansion of the phone bands has been discussed many times in the past, but very little or nothing has been done to change things around. We have today more or less the same distribution of segments for CW and phone that we had forty years ago. In the last decades, ham radio experiments and advances have caused an extraordinary transformation. To mention a few: SSB, FM, VHF, UHF, RTTY, ATV, SSTV, facsimile, satellites, moonbounce, etc., etc.

With all these modes and fields to research and experiment, the spectrum of the bands has remained the same as when CW and AM were the prime modes of communications.

The time has come for a complete overhauling and restructuring of the ham bands. We are a technology-oriented group and it is natural that we must cope with this problem in a technological way. It is very simple to feed an appropriate computer with all the data and information on the number of hams, modes of operation, percentage of time on the air, most used bands and frequencies, traffic handling, foreign reciprocal licensees and their operation habits, etc., and we can come out with a plan for the appropriate distribution of band space. You can allocate ten CW signals on the same space as one SSB, and logistically the CW segment in the bands only needs to be a fraction of the space for SSB. RTTY with narrow shift is another mode that does not take too much space.

If you take a good look at the 20 meter band, one of the most popular and crowded, you will find that American amateurs (Advanced and Extra) can work phone only from 14.200 to 14.350 (150 kHz), while the spectrum for CW is from 14.000 to 14.350 for Extras and 14.025 to 14.350 for Advanced and General. That means that you can work the whole band on CW, but only a fraction on phone. Why this strange rule if only a small fraction of active hams work CW?

I am a CW man myself, I have an Extra ticket, and think that CW is one of the greatest and sure forms of communication, but I am not a fanatic and like to live with reality.

Somebody told me that the reason for the phone band limitation was an old international agreement so we don't QRM the DX stations with our powerful linears. I think decades ago this was a very gracious gesture by the American hams to their colleagues abroad. But the situation has changed dramatically. Today these fellows are using full gallons, and in America we have thousands of reciprocal licensees that devote their time to phone patching and handling traffic for their countrymen in the USA. I am not against the reciprocal licensing. I think it is wonderful. The only trouble is that this traffic is jamming our narrow phone bands precisely in the lower sectors. Please, take the trouble to tune the 20 meter band from 14.200 to 14.250 and you will hear the traffic going on.

But here is what happens when you need traffic for Cucamanga. You heard a station on 14.155 broadcasting from Cucamanga, but you couldn't call the gentleman and ask him to phone patch Aunt Myrtle, because American hams are not allowed to work phone under 14.200. You can't even call them in CW, because most do not know code. Now, on the other hand, when the gentleman in Cucamanga needed Miami, the only thing he had to do is come over the 14.200 and ask us to phone patch Aunt Juanita. And we generally do it. Noblesse oblige.

I don't think this is a fair situation. And I don't believe that it is reciprocal and just.

We've come a long way. Ham radio is not spark gap anymore. The tremendous strides in technology, the diversification of modes, the advance of the state of the art, call for a fast revision of band allocations and the time to do this is here, NOW.

Albert H. Coya WB4SNC
Miami FL

Sweet Mystery of Life

As it may come to any neighborhood, scandal trailed across the ridges recently and one of the local QRPers ran off with a young widow to live in idyllic bliss high in the ranges. Finally, one of the local QRPers had to look them up, and he came back with the sad report.

"It sure is something," the QRPer reported. "Here he gets up every morning at the break of day to watch the sunrise and his bellowing of 'Ah, Sweet Mystery of Life at Last I've Found You' goes echoing through the canyons. How do you figure these things happen to a fine fellow? How do they happen?"

We had to admit that we had felt some concern over these events and finally had to ask the inevitable. "Do you think he's happy?" we said, and the QRPer snorted.

"How could anyone be happy," he said, "standing outside in the morning sunrise and yelling, 'Oh, now I know the secret of it all'? And all this time the morning DX path will be fading and he has missed all the DX again. How could one be happy with that?"

Son of a Gun, we had to admit that he had a point there.

* * * * *

Last week we came across another one of the local QRpers and we just had to ask how he had done in the recent DX Test. Maybe we should have talked of other things: It was not joy that crossed the face of the QRPer, and we had to listen to his story.

"I figured that in this contest I would aim for new countries," he explained, "and I latched on to one that I needed early in the test. But I called and called and called. And I never did work him, I never worked him at all."

The QRPer paused under the weight of the emotions that raged within, but finally he pulled himself together and was able to continue. "I never did work this fellow I was calling. I never got him to come back to my call. Chased him for the whole weekend but things just did not work out."

We were properly sympathetic, for we also have known the lonely nights of frustrated DXing. "Who were you calling?" we asked, and that was another mistake.

The QRPer shrugged. "UP2KHZ was the station I needed," he mumbled. "He kept giving his call and I kept calling him all weekend but I never did work that Lithuanian. The first UP2 I've heard in years. The first in years."

You know something? We thought this over for a bit, but what could one say in a situation like this. Only that often the chase is long and the quarry elusive. And sometimes one will chase one thing while thinking it is something else. And wishing to take from no man his dream, we said nothing at all.

Give not your sympathy to the chaser of the elusive UP2s, he was not the first to hear the call . . . once there was a UF0OL on Franz Josef . . .

Reprinted from the West Coast DX Bulletin.

CONTESTS

Editor:
Robert Baker WA1SCX
34 White Pine Drive
Littleton MA 01460

WATT Award

TIARA is now offering an award for working ten TIARA members within a year, beginning August 1975. Five of the ten members must be non-Japan stations. Send a self-addressed envelope with sufficient IRCs to TIARA, 22-5 Oyama-cho, Shibuya-ku, Tokyo 151, Japan, for a list of call-signs to look for. QSLs and 500 Yen (or equivalent) should be sent to JA1ADN, Fred N. Ihara, of *CQ Magazine/Japan*. His home address is: 8 - 4 Tokyu, Matoba, Kawagoe 350 Japan.

STRAIGHT KEY NIGHT
Starts: 0100 GMT Thursday, January 1, 1976
Ends: 0700 GMT Thursday, January 1, 1976
(Remember, this is actually Wednesday, December 31 local time.)

Suggested frequencies are the areas of 060 to 080 kHz up from the bottom edge of the band on 80-40-20, 10 kHz up from the bottom edge of the Novice segments. Work CW only using a straight key. Bugs, keyers, CW keyboards, etc., are not allowed. Use "SKN" in place of "RST" when exchanging signal reports.

REPORTS:

Immediately following straight key night, send a list of the calls of the stations worked along with your vote for the best fist heard that night (you don't have to work him). Send to: American Radio Relay League, 225 Main Street, Newington CT 06111.

Check the December issue of QST for any last minute changes in the contest rules.

ARRL VHF SWEEPSTAKES
Starts: 1400 Your Local Time, Saturday, January 3, 1976
Ends: 2400 Your Local Time, Sunday, January 4, 1976

Complete rules for the 29th VHF Sweepstakes can be found in the December issue of *QST* (please check for any last minute changes in the rules). Briefly, the rules are as follows:

All amateurs operating on or above 50 MHz are invited to participate. Contacts between stations in different time zones can be counted only when the contest period is in progress in both zones. Foreign stations may only work stations in ARRL sections. Crossband work is not allowed as well as retransmitted signals (repeaters). Contacts with aircraft mobiles cannot count for section multipliers.

EXCHANGE:

QSO Number, precedence (A = less than 50 Watts input power), your call, CK = last 2 digits of year first licensed, ARRL section or country.

SCORING:

Score one point for each exchange sent and each received (max. 2 points per QSO). Each section counts as a multiplier only once regardless of band and no more than one foreign country may be claimed as a section multiplier. Yukon-NWT counts as a separate multiplier. Final score is the total number of QSO points times the total number of sections plus 10.

LOGS:

Official logs may be obtained from ARRL. Send contest logs and summary sheet to: ARRL, 225 Main Street, Newington CT 06111.

DX-YL to NA-YL CONTEST
CW
Starts: 1800 GMT Wednesday, January 14, 1976
Ends: 1800 GMT Thursday, January 15, 1976

Phone
Starts: 1800 GMT Wednesday, January 28, 1976
Ends: 1800 GMT Thursday, January 29, 1976

Sponsored by the YLRL, the contest is open to all licensed *YL* operators throughout the world. Contacts with OMs and net contacts do not count. General call is "CQ DX YL." All bands may be used but no crossband operation is allowed. Stations may be worked and counted once on each band and mode. Phone and CW contacts will be scored as separate contests, so submit separate logs.

EXCHANGE:

QSO number, RS(T), country or state.

SCORING:

Each QSO counts one point. Multiply the number of QSOs by the number of states or countries worked. If running 150 Watts input or less on CW and 300 Watts PEP or less on phone, multiply the total score by 1.25 (low power mult.). Your logs must show the input power you are running.

LEGAL CONTACTS:

DX-YLs will include Hawaii and may contact all of the North American continent which includes the states and Canadian provinces. Alaska YLs will be counted as DX but may not contact the Western Canadian provinces of VE5, VE6, VE7 and VE8. Alaskan YLs may contact Hawaii, the states, or the Eastern Canadian provinces. Contestants in the North American area may score contacts with DX stations, including Hawaii and Alaska (except as noted above). The Western Canadian provinces VE5 through VE8 may not contact or count Alaska as DX.

LOGS:

Entries in logs must show band worked at time of contact, time, date and transmitting power. Please print or type and use separate logs for phone or CW. Copies of all logs showing claimed scores and signed by the operator must be postmarked not later than February 5, 1976 and received by the contest manager not later than February 19, 1976, or be disqualified. Send logs to: YLRL Vice President, Beth Newlin WA7FFG, 826 W. Prince Rd. — 06, Tucson AZ 85705.

AWARDS:

Trophies will be awarded to the first place winner in each category, a plaque to the highest combined DX and NA scores, and certificates to the second and third place DX and NA winners.

QRP-WINTER-CONTEST
Starts: 1500 GMT Saturday, January 17, 1976

CALENDAR

Jan 1	Straight Key Night
Jan 3 - 4	ARRL VHF Sweepstakes
Jan 10 - 11	CD Party — CW
Jan 14 - 15	DX-YL to NA-YL Contest — CW
Jan 17 - 18	CD Party — Phone
Jan 17 - 18	QRP — Winter — Contest
Jan 24 - 25	Simulated Emergency Test
Jan 28 - 29	DX-YL to NA-YL Contest — Phone
Jan 31 - Feb 1	French Contest — CW
Feb 7 - 8	ARRL DX Contest — Phone
Feb 13 - 15	QCWA QSO Party
Feb 14 - 15	10-10 Net Winter QSO Party
Feb 21 - 22	ARRL DX Contest — CW
Feb 21 - 22	YL-OM Contest — Phone
Feb 28 - 29	French Contest — Phone
Mar 6 - 7	ARRL DX Contest — Phone
Mar 6 - 7	YL-OM Contest — CW
Mar 14 - 15	South Dakota QSO Party*
Mar 20 - 21	ARRL DX Contest — CW
Apr 3 - 4	Florida QSO Party
May 1 - 2	Helvetia 22 Contest (H22)
June 4 - 7	IARS/CHC/FHC/HTH QSO Party
June 26 - 27	ARRL Field Day
July 3 - 4	QRP — Summer — Contest
Aug 14 - 15	European DX Contest — CW
Sept 11 - 12	European DX Contest — Phone
Nov 5 - 8	IARS/CHC/FHC/HTH QSO Party
Nov 13 - 14	European DX Contest — RTTY
Nov 14	OK DX Contest

***Please note the change in date for this contest.**

If you have any information on a contest that is not listed, please let me know as soon as possible, and preferably at least three months prior to the contest date.

Ends: 1500 GMT Sunday, January 18, 1976

The contest is organized by the DL Activity Group-CW. Work 15 hours maximum during the 24 hour contest period, with no more than two pause periods. Select up to 5 bands from 160 to 10 meters. General call is "CQ QRP TEST." A station is not handicapped if CO/VXO control *and* VFO control are used on the same band or the input power of a commercial rig is reduced to below 2.5 Watts. QRO stations — same rules, but work only QRP stations and sign as ". . ./QRO"; scoring is the same.

EXCHANGE:

RST, QSO number, and input (1 to 9). Add "x" if transmitter is CO or VXO-controlled. Example: 579 005/8x.

SCORING:

QSOs with all stations are valid unless running QRO, then only QSOs with QRP stations count. Contacts with your own country count 1 point, own continent = 2 points, DX = 3 points, and score 3 additional points for a QSO with another QRP station (4-6 pts.). Score additional handicaps as follows: 1 handicap point for each station using below 3.5 Watts input or crystal controlled transmitter. Maximum handicap is 4 for any QSO. Both stations multiply QSO points times the handicap points plus one (QSO pts. x 5 max.) to find total QSO points for that contact. Multipliers are as follows: own continent = 1, DX = 2 points per band and country according to the latest DXCC list, but call areas in JA, PY, VE, VK, W and ZS count extra. Final score is total QSO points (including handicap pts.) times the total multiplier.

LOGS:

Send entry including a "mini-log" to: Hartmut Weber DJ7ST, D-3201 Holle, Kleine Ohe 5, Fed. Rep. of Germany. Logs should be sent no later than February 15, 1976.

1976 FRENCH CONTEST
CW
Starts: 1400 GMT Saturday, January 31, 1976
Ends: 2200 GMT Sunday, February 1, 1976

Phone
Starts: 1400 GMT Saturday, February 28, 1976
Ends: 2200 GMT Sunday, February 29, 1976

EXCHANGE:

French stations will send RS(T) and number of department. All other stations send RS(T) and QSO number.

SCORING:

Score 3 points for each QSO with French stations or French speaking countries (DUF, ON, HB, LX, VE2, OD, HH, 3B, 9U-Q-X). Score 10 points for contacts with F8REF, department ØØ.

MULTIPLIER:

Count one multiplier for each different department, ON province, HB canton, and French speaking country per band.

FINAL SCORE:

Final score is the total number of QSO points times the total multiplier points.

LOGS:

Send logs to: Lucien Aubry F8TM, Rue Marceau 53, 91120 Palaiseau, France.

Continued

RESULTS

RESULTS OF THE 1975 WASHINGTON STATE QSO PARTY

The following list shows all stations that received certificates for their participation in the contest. VE7ZZ/W7 was first overall in Washington and KØGJD/6 was the first overall for outside Washington.

Alaska	KL7HDX	1,170 points
Arizona	K7AL	1,978
California	KØGJD/6	9,242
	W6KYA	1,590
Colorado	KØQIX	2,124
	WBØGEX	1,944
Connecticut	WA1KMP	360
Florida	K4HWW	2,204
	WB4OGW	2,200
	W4LIN	1,232
Georgia	WA4APG	540
Illinois	W9WR	702
Iowa	WØPRY	1,620
Kansas	WBØIAQ	1,224
Kentucky	W4KFB	572
Maryland	W3YHR	204
Massachusetts	W1AQE	1,066
Michigan	W8CNL	1,120
	WB8PFB	814
Minnesota	WBØMAO	540
Mississippi	W5RUB	520
Missouri	WØQWS	1,824
New Jersey	K2JFJ	190
New Mexico	WA5YTX	464
	W5TIL	460
New York	W2MEI	704
North Carolina	WA4MWP	640
Ohio	W8CSK	224
Oregon	K7DRD	180
Pennsylvania	W3ARK	500
Rhode Island	K1QFD	320
South Carolina	K4HQU	266
South Dakota	WBØEVQ	1,620
Tennessee	WB4WHE/4	600
Texas	WB8FUO/5	1,560
	W5SOD	912
Vermont	K1IIK	36
West Virginia	WA8CNN	154
Wisconsin	W9YT	1,768
	K9DAF	396
CANADA — Manitoba	VE4UO	180
Ontario	VE3EJK	864
JAPAN	JA2HGA	280
	JA1WVK	266
	JA7KE	256

Washington State Winners

W7GHT/M7 won first place from the following 12 counties: Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Kittitas, Lincoln, Okanogan, Pend Orielle, Spokane, and Walla Walla.

Other winners are as follows:

Cowlitz county	WA7LQQ, WA7PMW	13,440 points
	W7FGD/7	130
Grant county	W7GYF	9,045
King county	VE7ZZ/W7	79,424
	W7YTN	27,144
	K7JCA, W7EXM and WA3DVH	19,482
	WB5NLE/7	14,617
	WA7FHG	12,150
	WA7UQG	11,660
	WA7VBT	11,186
Kitsap county	K3USH/7	4,284
Mason county	W7IEU, WA7FKM	3,102
San Juan county	K7NHG	6,437
Snohomish county	K7NCG, WA7SLO and K7UWT	46,787
	WA7ZSJ/7	126
Wahkiakum county	WA7BSQ/7	576
Whatcom county	W7EKM	3,140
Whitman county	W7YH	29,412

ARRL DX COMPETITION

Phone
Starts: 0001 GMT Saturday, February 7, 1976
Ends: 2359 GMT Sunday, February 8, 1976
Starts: 0001 GMT Saturday, March 6
Ends: 2359 GMT Sunday, March 7

CW
Starts: 0001 GMT Saturday, February 21
Ends: 2359 GMT Sunday, February 22
Starts: 0001 GMT Saturday, March 20
Ends: 2359 GMT Sunday, March 21

These rules were taken from last year's contest, since the ARRL has not released information as of this writing. Check the December issue of *QST* for complete rules and any last minute changes.

Briefly, the rules are as follows: All fixed station amateurs, worldwide, are invited to participate. All amateurs in the 48 states and Canada will try to work as many stations in other parts of the world as possible. All other stations will work only W/VE stations. Entries may be in either the CW or phone section; each is scored independently. Entries are further classified as single or multiple operator stations. Single transmitter multi-operator stations will be recognized as a distinct category from multi-transmitter, multi-operator stations. Two transmitters on the band at the same time is prohibited. Single operator stations may enter in either the all band, high band, or low band categories. High band is 20, 15 and 10 meters, while low band is 160, 80 and 40 meters. Operating on a band not allowed in your class is permitted but those points will not be counted toward your total score. Crossband and crossmode contacts are not allowed.

EXCHANGE:
W/VE stations will send RS(T) and state or province. All others send RS(T) and power. KH6 and KL7 are considered DX.

SCORING:
Score 3 points for each completed QSO. Each station may be worked once on each band on each mode for contact and multiplier credit. Final score is the total number of QSO points times the total number of countries on each band (for W/VE stations), or the total number of continental states plus VE/VO licensing areas worked on each band (for DX).

AWARDS:
A plaque will be awarded to the highest single operator DX phone and CW station (non-W/VE) in each continent. On both phone and CW, a certificate will be awarded to the highest scoring station in each category and classification in KL7, KH6, each ARRL section, and each country where a valid entry is received. Also, a certificate will be awarded to each non-country winner DX entrant making 1000 or more QSOs on either mode. ARRL-affiliated clubs may also participate in club competition as described in *QST*.

LOGS:
A summary sheet, log sheets, and DX check-off sheet for each band used is required from all W/VE entries. DX entries must submit log sheets and a summary sheet. Separate logs, summaries, and check sheets are required for each mode used from all entries (no check sheets for DX). Logs and forms are available from ARRL, 225 Main St., Newington CT 06111. Send completed forms and logs to ARRL at the address above no later than April 1976.

RESULTS

RESULTS OF THE 1975 FRENCH CONTEST

Number of Participants

	CW	Phone
France	334	423
French speaking	95	198
Other countries	445	203

Top French Stations (single operator)

F3CY	CW	809,100 points
F8OP	Phone	832,688
5T5FP	CW	678,524
6W8DY	Phone	3,829,184
F6AXV/MM	Phone	836,082 (zone 39)

Other Countries (single operator)

CW	LZ1GX	259,449 points
	OD5LX	27,880
	W8KPL	25,410
	PY7ALC	7,030
Phone	I3MAU	274,298 points
	OD5BA	26,635
	VE3BS	30,615
	PY1EMM	175,812

Multi-Operator

CW	UK3ABB	286,116 points
	UK9ABA	83,720
Phone	4U1ITU	713,657
	DLØOC	198,450
	UK9CAE	83496

QCWA QSO PARTY

Starts: 2300 GMT Friday, February 13, 1976
Ends: 2300 GMT Sunday, February 15, 1976

Every contact with another QCWA member will count. Briefly the rules are as follows; check the *QCWA Newsletter* for any last minute changes.

EXCHANGE:
QSO Number, QCWA Chapter Name, and operator's name. Send "none" in place of chapter if not affiliated with a chapter. Holders of Golden 50 Year Certificates should add the suffix "D" after their QSO Number.

SCORING:
Contacts between members living in their own or adjacent countries count one point. Contacts between members living in nearby countries that are separated by an intervening ocean or country count as two points. Contacts between members living on different continents count as 5 points. Contacts between any member and a member with a 50 Year Golden Certificate count for one additional point. A contact with the QCWA memorial station W2MM/4 counts for 2 points. Stations may be worked both on CW and phone but only once on each regardless of band. Multiplier: Each different chapter represented in your contacts counts as a multiplier. Final score is obtained by multiplying the total number of QSO points by the total multiplier.

FREQUENCIES:
Phone: 1805-1825, 3940-3960, 7240-7260, 14240-14260 28640-28660, 14280-14300
CW: 1805-1825, 3540-3560, 7040-7060, 14040-14060 21040-21060, 28040-28060
Contacts made on frequencies outside the listed bands or on QCWA or other net frequencies are not valid and will not count in your total. You may answer on any frequency in the listed bands, but you should not stay on any frequency except that whose last digit is your call area (Example: W7/K7 would call CQ on 20 meters on 14247 or 14257 if on phone or 14047 or 14057 on CW.) This restriction does not apply to stations outside the 48 states.

AWARDS:
This year QCWA will award certificates to chapters with the three highest aggregate scores. At least three entries must be received from the chapter. The "Annual Operating Award" plaque will be presented to the highest scorer in the contest. Presentation of the award will be made in June, 1976. Scores will be printed in the June 1976 issue of the *QCWA Newsletter*. If you contact W2MM/4, include a QSL card of your own to receive a special memorial card from QCWA Headquarters.

LOGS:
A sample log may be obtained from Dave Davis by sending an SASE to him at: 6971 Grand Vista Way, South, St. Petersburg FL 33707. Identify each sheet of your log with your name, call, address, city, state and zip. Number pages serially and staple them together. List your chapter name and Golden Certificate Number, if you have one. Logs should show: time (GMT), freq, call, QSO nr. sent, QSO nr. received, his chapter, operator's name, mode, QSO points, and multiplier points – for each QSO. Compute your own score and include it with your logs. Logs should be mailed not later than February 15, 1976 to Dave Davis W4GQ at the above address. In case of controversy, the judges' interpretation of the rules and their decision is final.

Continued on page 11

Looking West:

Ventura '75

Bill Pasternak WA6ITF
14725 Titus St. #4
Panorama City CA 91402

The traffic on 101 heading north seems quite light for this hour on a Saturday evening ... for long stretches it seems that this Torino is the only vehicle on the road ... another vehicle passes and that sets me to wondering out loud ... here I sit at 55 ... the maximum limit that one can legally travel without the CBers' pal "Smokey" doing his number on you, and on a major freeway with this little traffic on it ... well, a speeder just stands out like a sore thumb. Anyone who risks the wrath of the CHP (California Highway Patrol) to save a couple of minutes while enroute from point "A" to point "B", and risks not only his life but that of everyone else on the highway, has got to be a "bad guy" in my book. Besides, the evening is so clear that to speed would only take a lot away from the excitement of the events to come later this evening ... relax, if you are a few minutes late for the evening's festivities ... so what? ... WR6ABE, Burt's repeater on Mt. Wilson, breaks squelch on the Motorola as I start up a rise ... damn thing has ears that seem to hear everywhere and a voice to match ... well, here's my chance ... better give Bill a call and confirm things ... "KH6IAF/6 Ventura from WA6ITF mobile 6 ... are you there Bill?" ... "WA6ITF mobile 6 from KH6IAF/6 ... what's your ETA, Bill?" ... "About half way there and expect to be about 10 or 15 late ... go." ... "OK ... call me on .52 when you reach the California Avenue off-ramp. The hotel is just across the highway ... go." ... "Call you on .52 in about 25 minutes ... 73s for now. KH6IAF/6 Ventura from WA6ITF mobile 6 on highway 101 clear WR6ABE" ...

That, friends, is the way the weekend began. While most people attending this year's ARRL Southwestern Division Convention had made their plans weeks earlier, I had not been sure until about three that afternoon as to whether I would or would not make it. Already, I had missed the first 1½ days of the get-together due to business commitments, but the lure of an event such as this is just too much for yours truly to resist. Besides, I had to be there by noon Sunday to cover the SCRA meeting for this column. Mainly, I did not want to miss the banquet this evening. No, not for the food, though a good dinner was promised; it was the keynote speaker at the banquet that I wanted to hear.

There are very few people that I truly admire, people who have developed within their chosen field of endeavor to a point of true overall professionalism, to a point where society recognizes them as being the best in their business. The man that was to speak this evening was one of those few and, as someone involved in the same profession, though on a far more limited scale, this was one time that I intended to be there. Hence the rush to leave work at 6 pm and be at the Holiday Inn in Ventura by 8.

From the very beginning of the United States space program, the broadcast media have always given coverage of the events top priority. From the first experimental Vanguard flights of the late 50s and early 60s, to Alan Shepard's first manned flight, to our first moon landing, to last summer's Apollo-Soyuz joint U.S.-Soviet venture, we had but to turn on the one-eyed monster to "be part" of it.

Covering events of this magnitude takes the skill and talent of many people, and I suspect that one could sit and compile lists that might well be longer than an edition of this magazine. Technicians, engineers, reporters, editors: Specialists in every aspect of news dissemination, working with a combined effort to bring the story to you at the moment it happens. Professionals in the true sense of the word, and among these one name has always been a part. One person has always been a part of space flight news coverage as far back as I can remember: Roy Neal of NBC News. To most Americans he has been one of the knowledgeable voices that has guided them through the intricacies of space flight — both manned and unmanned. To us, the members of the amateur radio community, he is more than that, for he is one of us; he is Roy K6DUE, an amateur radio operator in which our entire community takes pride.

Roy began his talk; one could feel the silence of his audience, the kind of silence that is given to show respect for the person who was about to address them. He recounted the subject that he knows well: the history of space flight from its infanthood to the marvel of the Apollo-Soyuz orbital link-up. His explanations of how early attempts at media coverage and the rather crude methods used back then were eventually developed into polished format as a result of technology gained from the Space Program itself were extremely enlightening. Today, we have come to take live television pictures from space as commonplace, but how many of you remember those tense moments of anguish in the days before communications satellites? Waiting for a reporter's voice to crackle in sometimes heavily QSBing SSB to note that a safe splashdown had occurred and our astronaut was back safely? I do ... it was not all that long ago.

One might say that Roy took us on a trip through time: back to the beginning, up to the present and then perhaps a peek at the future. He told us how the knowledge gained as an amateur radio operator has aided him in the past and continues to aid him in developing the communication links necessary to cover these events. You could feel the pride that this man has in being a member of the amateur radio community. Throughout his talk he subtly tied his profession as a broadcast journalist to his love of amateur radio in a way such that you could almost feel that the two were inseparable — yet at the same time totally independent entities.

I suspect that it was his closing remarks which caught the imagination of every amateur present, especially those of us who are VHF-oriented. The space shuttle will be the next step in the story of man's conquest of space and eventually, maybe even in our own lifetime, men may live on the moon or other celestial bodies. To paraphrase Roy, eventually there may be amateurs on the moon and perhaps even repeaters up there ... the pictures that formed in my mind were unreal. Imagine working the world on

VHF or UHF with but one squelch tail ... imagine the thrill of the day when there will be an amateur repeater on the moon ... the thoughts just blew my mind completely. When he finished, there came an ovation befitting the speaker and the words spoken.

As I sit here writing this some two weeks later, I cannot help but think that I was witness to something special. I have done much soul searching trying to find a reason for this feeling, but alas, I can only guess at it. Maybe it's due to my desire to emulate people like Roy and his colleagues (though on a far smaller scale) here in this column – a feat that I doubt I will ever achieve. To take on a responsibility such as Looking West or any other form of news reporting endeavor as an ongoing project is no easy task. There has got to be a love of what you are doing and a sense of responsibility to make sure you strive to do your best. In the many times I have watched Roy on the "tube" doing his job, I have gotten just this feeling – that of the true professional doing the kind of work he loves, the kind of work that is a part of him. Anyhow, for about 40 minutes on the evening of October 25, 1975, in the city of Ventura, California, there was a special kind of magic, a magic I will always remember.

Next month we will tell you a bit more about the Convention itself, but for now it's time to get on with some of the FM news – and that means the SCRA meeting held in conjunction with the Convention on Sunday, October 26th. If I were to choose one word to describe the major accomplishment of this particular meeting, it would be "Reunification." As reported last month, we were awaiting the outcome of "Concord '75," a meeting that would decide if there would or would not be a statewide coordinating council and, if there was, exactly what form it would take. Unfortunately, my deadline was about a week prior to the aforementioned meeting, so we can only now report that there will indeed be a CARC, basically along the formative lines outlined in earlier columns. The newly reorganized CARC got a real "shot in the arm" with the decision of the SCRA general membership to have the SCRA formally affiliate with CARC as southern region 144 MHz and 220 MHz liaison. (I use the word "liaison" for lack of a more descriptive word.)

Roy Neal K6DUE of NBC-TV News speaking at the ARRL Southwestern Division Convention in Ventura. Photo by Bill Pasternak WA6ITF; special processing by George Roberts.

The SCRA will still retain its own authority within its administrative area, and will continue operations as it has in the past. Its move to affiliate is one of support of the concept of a statewide organization overseeing problems of a statewide or national nature. It remains now to see if the Northern California repeater and remote owners, i.e., the recently established NARC organization, will also affiliate.

As it was explained by Gary Wood WA6DTX of the CARC, great care has been taken to structure the "new" CARC to prevent any sort of unilateral power structure from developing. The directorship will consist of representatives from each of the four (yes, I know that past columns had said three, but at Concord it was decided that there would be four regional bodies) regional coordinating bodies. Each regional body will appoint three people to act as area representatives to the CARC Executive board and any one member of this board will have veto power over the actions of the entire board. The remaining three board members will be the officials of the CARC itself, and this body *will not* involve itself in matters of local coordination policy or with local standards and practices. The main purpose of the "new" CARC is to provide the California FM community with a totally unified front in dealing with other areas and other organizations such as the FCC, the ARRL, etc. The vote to affiliate was unanimous and, along with SCRA's current chairman Dick Flanagan, Bob Thornberg WB6JPI and Dick McKay K6VGP were elected as SCRA representatives. (As SCRA Chairman, Dick Flanagan's appointment was automatic.)

I suspect that Gary summed up the goals of the "new" CARC best in his opening remarks. To paraphrase what he said, at one time about ten years ago we were all one FM community, but over the years we have permitted ourselves to drift apart and become individual interest groups (such as repeater and remote). The aim of the reorganized CARC is to bring all special interests together once more under one roof for the continued well-being of amateur radio. The first general membership meeting of CARC will be held here in the southland next spring, and at that time I hope to be able to report on some "good things" coming from CARC.

Talking about official recognition, the amateur radio community really got some of the best yet. About a year ago, a group of local amateurs banded together and formed the Community Amateur Radio Service, an organization that has worked along with the Los Angeles Police Department in an effort to help thwart the spread of crime. These amateurs have devoted their spare time in public service toward their community and their success has been such that the LAPD has seen fit to issue the following letter to the CARS people:

William Orienstein
President C.A.R.S.
C/O N.B.C. T.V.
3000 W. Alameda
Burbank, California

Dear Mr. Orienstein

Citizen involvement with local police is of paramount importance in any crime prevention program. During the last year your organization has been instrumental in combating rising crime patterns within our area. Please convey our commendation to your entire organization. Your help has undoubtedly reduced crime in areas of deployment and saved our taxpayers in time and money.

If my office can be of any assistance during subsequent deployment please contact me.

(s) L. Binkley, Lieutenant II
North Hollywood Area
Community Relations Officer

Talk about good public relations! In my book the foregoing is super good "PR" for the amateur radio community: Amateurs working hand in hand with the police to make a safer community for you and me to live in. We need more groups like this all over the nation, since the concept of public service is one of the basic precepts of amateur radio itself.

CONTESTS

from page 8

TEN-TEN NET
WINTER QSO PARTY
Starts: 0001 GMT Saturday, February 14, 1976
Ends: 2400 GMT Sunday, February 15, 1976

The contest is sponsored by the Ten-Ten International Net of Southern California, Inc., and is open to all amateurs – but only 10-10 members are eligible for awards. All contacts must be made on 10 meters, any mode, and a station may be counted only once.

EXCHANGE:
Name, QTH and 10-10 number.

SCORING:
1 point for each contact; 1 point if with a 10-10 member; 1 point if outside your own state, province or country. Maximum of 3 points for any one contact.

LOGS:
Logs should include date and time of each contact as well as the required exchange information.

AWARDS (for 10-10 members only):
Certificates to first and second place winners in each US district, Alaska, Hawaii; each VE district; Central America and Caribbean; South America; Europe; Africa and South Atlantic; Asia and Northern Pacific; Australia, New Zealand and South Pacific. Send logs to Grace Dunlap K5MRU, Box 445, La Feria TX 78559, by April 1, 1976. For complete results, see the *10-10 Net Summer Bulletin.* To become a 10-10 member, work any 10 members and send a list of those contacted along with $3.00 to the manager in your district.

RESULTS OF THE 1975 QRP – SUMMER – CONTEST

QRP Section **(first 10 places of 54 entries)**

	Call	*Points*	*Bands*	*Input Power*
1.	WB9LGZ/9	12908	40	3 Watts
2.	GW4DOO	10976	40-15	9 & 5
3.	G3IGU	8088	160-15	3 & 8
4.	G3DNF	7688	80-15	3 & 8
5.	HB9QA	6250	160-20	8 & 3
6.	DJ7MG	6187	80-20	7
7.	DL6ZG/P	5662	80-20	2
8.	DJ3WM	5439	80,20,15	5
9.	GW3PG/P	5372	160-20	2 & 3
10.	G3NEO	4986	80-10	2

Best Band Results

Band	*Call*	*Score*
160	DJ1ZB	180
80	DJ9IE	2680
40	WB9LGZ/9	12908
20	OK1MGW/P	1485
15	G3DNF	1040
10	DK5AQA, DK7QJA	78

First place in the QRO section (of three entries): DM2FIL/P, with 48 points.

RESULTS

SOCIAL EVENTS

MANSFIELD OH
FEB 8

The Mansfield Mid-Winter Hamfest/Auction is now a new day and location. It will be held on Sunday, February 8, 1976, at the Richland County Fairgrounds. Forums, large indoor flea market area, displays, door prizes and auction; easy access from I71 and US 30. Registration $1.50 in advance, $2.00 at the door. Tables for flea market $1.00 each. Doors open at 9 am; auction begins at 2:00. No commission charged. Talk-in 3,972.5 kHz 146.52 and 146.34/94 MHz. Additional info and advanced tickets from Harry Frietchen, Jr., K8JPF, 120 Homewood Rd., Mansfield OH 44906. (419) 529-2801 home; (419) 524-1441 work.

WHEATON IL
FEB 8

The Wheaton Community Radio Amateurs annual midwinter hamfest is Sunday, February 8, at the DuPage County Fairgrounds, Wheaton, Illinois (Manchester Road, near County Farm Road), 8 am to 5 pm. Tickets $1.50 advance, $2.00 at the door. For advance tickets send $1.50 each and a self-addressed stamped envelope to L. O. Shaw W9OKI, 433 S. Villa Avenue, Villa Park, Illinois 60181. Advance tickets postmarked no later than February 1.

TRAVERSE CITY MI
FEB 14

The Cherryland Amateur Radio Club will hold its third annual Swap 'n Shop on Saturday, February 14, 1976 from 9 am to 4 pm at the Northwestern Michigan College campus in Traverse City. Talk-in 146.52 and 3935. Door prizes will be given away. For more information contact Bill Mader WA8WWM, Box 2, Empire A.F.S., MI 49630. Donation is $1.00.

CUYAHOGA FALLS OH
FEB 27

The 1976 Cuyahoga Falls Amateur Radio Club Annual Auction and Flea Market will be held on February 27, 1976 at the Bolich Jr. High School, Cuyahoga Falls, Ohio. Admission $1.50 advanced registration. Deadline February 1, 1976. $2.00 night of auction. Talk-in frequency: 84/24-04/64-52/52. Call: W8VPV. Advance tickets: K8VAK and XYL, 3043 De Walt Dr., Akron OH 44312, 216-644-1213.

ROCK FALLS IL
MAR 7

The Sterling Rock Falls Amateur Radio Society Hamfest will be held March 7, 1976 at Sterling High School Field House (bigger and better location), 1608 - 4th Avenue, Sterling IL 61081. Tickets $1.50 advance – $2.00 at door. For info write – Don VanSant WA9PBS, 1104 - 5th Avenue, Rock Falls IL 61071. Talk-in 94 simplex.

VERO BEACH FL
MAR 20-21

The Bi-Centennial Treasure Coast Hamfest will be held at the Vero Beach Community Center Saturday and Sunday, March 20 and 21, 1976. Sponsored by Vero Beach Amateur Radio Club, Inc., and St. Lucie Repeater Association, P.O. Box 3088, Vero Beach FL 32960.

WASHINGTON DC
MAR 24

1976 ARRL Technical Symposium on Mobile Communications will be held on the evening of Wednesday, March 24, 1976 at the Statler Hilton Hotel, Washington, DC. Areas of interest are: HF/VHF/UHF mobile communications, repeater technology and operations, signaling and control techniques, special mobile communications (AMSAT, ATV, RTTY, etc.); especially subjects of interest to both amateur and commercial mobile radio users. Summaries are due by February 1, 1976. Manuscripts, photo of author and biographical sketch of amateur/electronic background due by March 1, 1976. Write: Paul Rinaldo K4YKB, 1524 Springvale Ave., McLean VA 22101 or call (703) 356-8918 evenings.

ST. CLAIR SHORES MI
APR 4

The South Eastern Michigan Amateur Radio Association is holding its Eighteenth Annual SEMARA Swap 'N' Shop on April 4, 1976, from 8 am EST to 3 pm EST. It will be held at the South Lake High School in St. Clair Shores, Michigan, on the Southwest corner of Nine Mile Road and Mack Avenue.

MEADVILLE PA
MAY 1

The Northwestern Pennsylvania Swapfest will be held May 1, 1976 at the Crawford County Fairgrounds, Meadville PA. Free admission. $1 to display. Flea market begins at 10 am. Hourly door prizes and refreshments. Commercial displays welcome. Indoor if rain. Talk-in 146.04/64 and 146.52 MHz. Details: Crawford Amateur Radio Society, Box 653, Meadville PA 16335.

JAFFREY NH
MAY 15

The 1st Annual Fly In and Flea Market will be held Saturday, May 15, 1976 at the Jaffrey Municipal Airport (Silver Ranch) in Jaffrey, New Hampshire. *73 Magazine* will host the event. Picnic facilities, food stand, great ice cream, horseback riding available at Silver Ranch stables across the road from the airport (200 yds). Plenty of hangar space for exhibitors, etc. Come one – come all – if you can't fly – drive – but get here. Jaffrey is 6 miles south of Peterborough on U.S. Rt 202.

I am a subscriber to *73 Mag.* I think it is a very fine magazine. This note is written to thank *73 Magazine* for publishing Ham Help, as appears on page 6, Nov/Dec, 1975:

I wrote to Fred Kahn WB2TBC for ham help and within one week received an informative reply. The information will be of great value to me. Thanks to all the fine people at *73 Mag.*

Edward Victor WN8SEG
Lake Milton OH

World Radio News, a newspaper published for hams, 2509 Donner Way, Sacramento CA 95818, has offered to supply amateur radio clubs with the names and addresses of all amateurs in their respective areas who are newly licensed or upgraded. Our club has used this service since June 1975 and has received over 200 names so far.

We send each one a copy of our newsletter and an invitation to visit our next meeting. Over 10% have joined our club and more are coming each month. We give others the name of a club closer to their homes. A great service – use it.

Bob Reiley WB2FHN
Hall of Science Radio Club
Flushing NY 11352

HAM HELP

Please place my name in your Ham Help column.

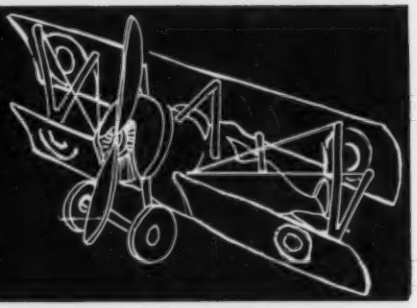
Mark A. Arnold
5022 Herme Place
Apt. E-5
Valdosta GA 31601

Please add my name to your list of Ham Helpers. As a ham I've had the most fun and learned the most while helping others get their license or upgrade. I have an Extra class license and a First Class Radiotelephone license and would enjoy sharing my knowledge with others interested in ham radio. My phone number is 272-4944. I'm available evenings and all day Saturday and Sunday. 73 and keep up the good work.

Tom Frisz WB9IUQ
19455 Staffordshire Dr.
South Bend IN 46637

Autobiography of an Ancient Aviator

W. Sanger Green
1379 E. 15 Street
Brooklyn NY 11230



To transport General MacArthur I had the real shaky ship pulled out of the back of the hangar and dusted off.

Langley Field Incidents - 1925

Along toward the end of October, one of my men told me that his mother was in serious condition in a Boston hospital and asked me for a few days furlough to visit her. I gave him the furlough and, in addition, I got Major Westover to authorize a flight to Boston for him. We started out early the next morning in a DH and got as far as Cape May, N.J., when we were forced down by weather. Next morning we got an early start, stopped at Lakehurst for weather information, fueled at Mitchel Field, and got to Boston by early afternoon. While my passenger was visiting his mother I tested a Moraine Parasol that a group had assembled but hadn't been able to find anyone to flight test. After inspecting it I offered to take it off and fly it around for a few minutes for $25 and another $25 if I landed it safely. I got my $50. I stayed the night with the Hal Bazleys. (I had delivered an LWF plane to him in 1923.) On the way back the next day I ran into treetop weather between Bolling and Langley. I decided that before the trees got any taller I had better sit down in the first field that came along. I landed in a muddy farm field near Mimini Grove, Va. The farm was run by four bachelor brothers. They had no phone, so I got them to hitch up a horse to a wagon and drive me to the nearest phone, which was in a small store three miles away. Then I checked in with Langley operations so they wouldn't start a search for us. While at the store I bought 10 lbs. of flour, 10 lbs. of sugar, 10 lbs. of salt and a gallon of molasses to take back to the farm. This was real back country. The farm was pretty much self-sustaining, so they were glad to get the staples I brought in exchange for dinner, bed and breakfast. They had no watch or clock on the place – lived by the sun. No electricity or running water (a pump over a well in the yard), but they did have a three hole back house. By noon the next day the field had dried out a bit, so I managed to lift off and get back to Langley that afternoon.

Sometime in September a young recruit was assigned to my squadron. I had a talk with him when he first reported: a nice kid just out of high school in the Pennsylvania Dutch country. He was assigned to one of the maintenance crews in the hangar. About the middle of November several bombers on the line were idling their engines preparatory to a formation takeoff when, for some reason, this recruit, who had been told to remove one of the wheel chocks, came from under the wing and walked right into an idling propeller. We sent a corporal and a flag home with him.

On the 30th of November my turn came to fly what they called the "Model Airway." This was a weekly scheduled DH trip that took 5 days, with stops at 16 Air Service fields from Detroit to St. Louis, and averaged about 25 flying hours. Anyway I was away on this trip when two of my lieutenants paid off the squadron for November. Among those they paid was the deceased recruit. The error wasn't discovered until a couple of months after all three of our tours of active duty had ended. The two lieutenants and I had correspondence with the Army on the subject for the next five years.

Sometime in September I got orders to provide a bomber and crew to transport General MacArthur to Bolling Field, D.C. I got the word that he was going to either testify at or be on the court of the Billy Mitchell trial in Washington. The message was clear so I had the real shaky ship pulled out of the back of the hangar and dusted off. I tested the engines, made a short test hop to make sure it would hang together, then set her out on the line to await the General's arrival. Oh! I forgot. I had my electrician rig a wire to the right engine ignition switch from a button on the side of my seat. When the button was pressed, the right engine would cut out. When MacArthur arrived, we fitted him out with helmet and goggles and loaded him into the copilot seat – and away we went. I pointed out the empennage (tail) that was fishtailing its way behind us and told him that, after all, we couldn't expect these WW I stick and wire planes that were engineered and built 8 to 10 years ago to last forever. I also told him that I thought we were just lucky that there was no war going on where we had to use the types of aircraft we had for any military missions etc., etc. In the meantime, that right engine kept misbehaving. I managed to keep our average ground speed down to about 50 mph on the trip. Upon our return to Langley that afternoon Old Wobbly was put in the back of the hangar again.

One day I was checking Bill Winston (an old friend from Carlstrom Field) out in a bomber. He was an excellent pilot but he had never flown a two engine plane. In about twenty minutes his air work was OK so I told him to try a landing. Before I go any further let me explain that in those days flying fields were all grass – no runways. So, to get on with the story, Winston was making a good landing approach into the wind when I saw a DH coming in for a landing downwind – and headed right for us. We were leveling off when I decided that the fellow in the DH hadn't seen us, so I poured on full power and told Winston to pull up right. We missed the DH so Winston took the ship around and landed it OK. We missed a collision by about 30 feet. This was not an enjoyable experience, so I went right to the field operations office to enter a complaint. While I was talking it over with the operations officer, who should walk in but Major Westover, the field Commandant. He was the pilot of the DH and was all shaken up. He took the entire blame for the incident and begged pardon, etc. I told him that we were all lucky and should be glad that we hadn't made the boys in the hospital heat up that big pot of wax.

Three or four nights a month we had to do a tow target mission for the anti-aircraft and searchlight batteries at Fortress Monroe. This was a bomber job. The target was about 25' x 10' and was made of canvas with weights to keep it flying as near horizontal as possible. A tow cord with release was attached to the tail of the bomber and then laid on the ground parallel to the takeoff run for about 1200 feet to the tow target. When you took off after dark you would pick up the target and climb as fast as possible and proceed to the Chesapeake side of Fortress Monroe at about 1500 feet. The searchlights would try to find the target and pass it on from one to the next. Then the anti-aircraft battery would shoot at (hopefully) the target. We would make passes over the battery for about an hour, each time coming over at a different altitude and from a different direction. Then we would go back to Langley, release the cord and target and land. It was sort of fun except that sometimes the anti-aircraft shells would come too close for comfort.

Next month I'll wind up my Langley Field tour of active duty with a couple of incidents and jump into the hotel and restaurant range business for awhile.

NEW PRODUCTS

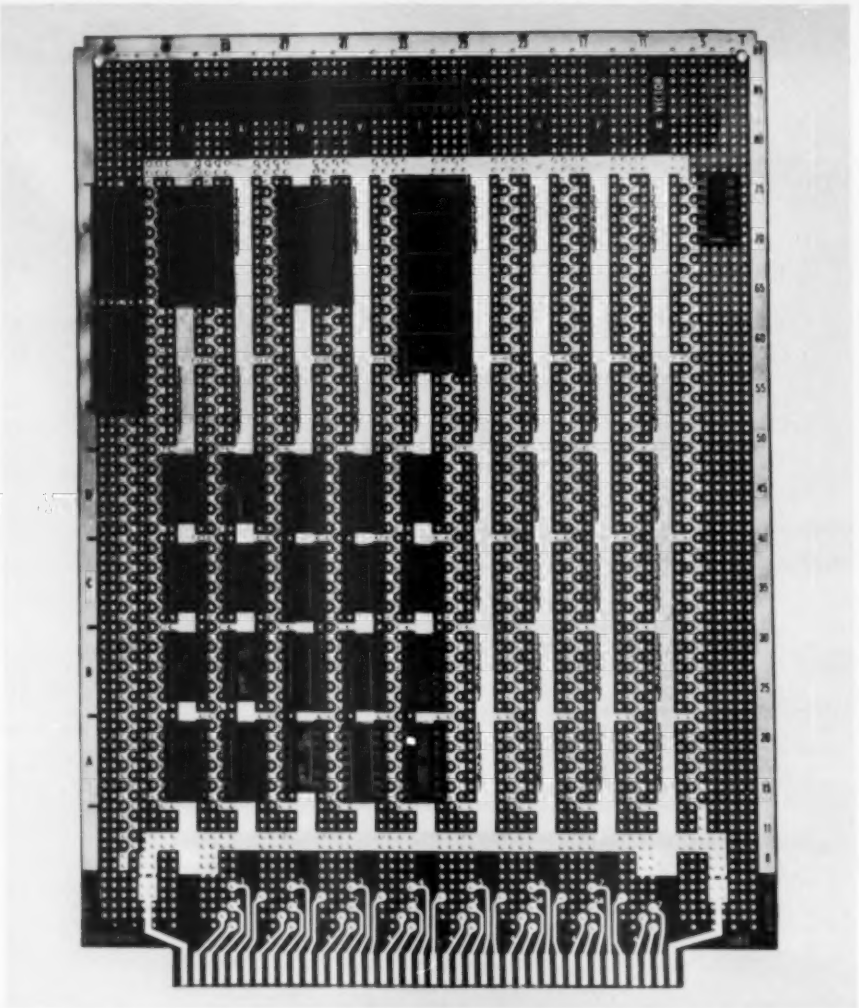
MICROPROCESSOR/INTERFACE BOARD OFFERS MULTI-LEVEL BUSING

A new Plugbord, from Vector Electronic Company, accommodates up to two supply voltage levels to permit the use of a wide variety of microprocessor and interface circuits. Designated Model 4350, the board has copper cladding on opposite sides for shielding and to supply primary power (plus on one side, negative on the other). Interwoven zig-zag lines, also on opposite sides, facilitate power distribution. The combination allows convenient use of both MOS and TTL devices.

Primary power buses, which pass under the DIP positions, are unperforated and opposite one another. This provides bypass capacitance for transient suppression. The zig-zag lines are also opposite but with the zigs and zags out-of-phase. There is ample space and mounting means on the board for bypass capacitors at each DIP position and also at the incoming power position.

The large 7 in. by 9.6 in. board will hold 63 fourteen or sixteen-pin DIPs. Alternately, five 24-pin microprocessors and 45 DIPs may be placed in the main field. Either socket blocks or individual socket pins may be mounted to order, or the board will mount 40-pin microprocessor (0.6 in. tab spacing) units. Plugbords may be purchased bare as Model 4350. Additional DIPs may be placed in the side margins or in a large unclad area at the top of the board. For input/output, the board has 40/80 etched contacts spaced on 0.125 in. centers. Unclad areas may also be used for DIP I/O connectors. Alternatively, tape cable connectors may be attached at the top or side of the board.

The DIP board, originally developed for interface with Texas Instruments' 980 Series computers, has a multitude of general applications. Due to the abundance of extra 0.041 in. dia. holes on tenth-tenth grid, the board may also be used for



Vector Plugbord Model 4350 (shown with added DIPs) accommodates 14-, 16-, 24- and 40-pin DIPs for use in a variety of circuit applications.

analog circuitry, mounting resistors and most other components easily. Either the Vector P173 Wiring Pencil technique (with solder) or wrapped connections may be used.

On the left side of the board the letters "A" through "I" mark each double nine-hole zone. Along the bottom the letters "O" through "Y" designate vertical zones. Like a road map, specific components may be called out by the coordinates. DIP pin numbers from 1 to 7 are etched into the clad area. General X-Y coordinate numerals are shown at top and bottom.

The Plugbords are made of flame retardant glass material and have all surfaces tinned except the contacts which are nickel-gold. Holes for ejectors are supplied for easy card removal.

The boards are priced at $14.95 each in 1-19 quantity, with quantity discounts available. They are in stock at Vector Electronic Company and may also be ordered through the firm's AVID distributors in the United States and Canada.

Vector is a major manufacturer of sockets, terminals, connectors, printed circuit boards, card cases, enclosures and complete packaging systems.

Vector Electronic Company, Inc., 12460 Gladstone Avenue, Sylmar CA 91342. Phone: (213)-365-9661; TWX: (910)-496-1539.

NEW MILLEN CATALOG

Remember when you could walk into a distributor and buy such goodies as coil forms, switches, mechanical drives, high voltage connectors and the like? They are still available factory direct, along with other goodies, from Millen. Send for their new catalog. *James Millen Mfg. Co., 150 Exchange St., Malden MA 02148.*

3 NEW HUFCO UNITS

Hufco — the makers of the popular 3 digit Communications Counter, TWS-3, designed specifically to read-out transmitted frequency — announces two new frequency counters and a prescaler. The two counters have 300 mV sensitivity and operate through 250 MHz. They are called the model TWS-300 and TWS-600 for three digits and six digits respectively. Both the three and six digit units outwardly look identical to their 30 MHz counterparts (no pun intended). Both come equipped with 115 V ac power supplies, but will work with 12 V dc through a 1 Watt dropping resistor. The most amazing thing about the counters is their price: The TWS-300 is $99.95 kit ($117.95 assembled) and the TWS-600 is only $119.95 kit ($139.95 assembled). Currently the units are available only from the factory, but dealer inquiries are invited (must be on letterhead).

Hufco's low cost prescaler works with any counter, and will multiply the capability of the counter by 10 up to 250 MHz. It comes assembled, with its own power supply on a single PC board suitable for inserting inside the case of your present counter. The low price is $59.95. Low frequency limit is approximately 1 MHz.

D-D's MAGNIFIER/LAMP

If you've been doing any IC construction projects or kit building, you are well aware that one of your most important needs is some way to see what you are doing. Enter the D-D Enterprises combination magnifying glass and fluorescent lamp which clamps on your workbench — or even a card table, if you are more the instant workshop type of builder.

The fact is that you need a lot of light and a lot of magnification to make sure that all those holes are soldered right on PC boards and that there are no bridges between islands or plug-in contacts. With the D-D you can work with both hands free and see exactly what you are doing.

Permission is granted to cut out this little piece and leave it for the XYL as a hint for a present. Look for the ads or write to D-D, Box 7776, San Francisco CA 94119. Costs less than $50. Be sure to see the ad in this issue.

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from page 3

Inputs are things like teletype machines, television typewriters, ASCII output keyboards, cassette tapes, paper tape . . . things like that. Outputs are mostly the same things. I/O. You'll like it.

I/O also represents the fundamental quantities of digital electronics, zero and one. Okay?

IS ANARCHY SO BAD?

While I've only been listening to the citizens band in New England and New York, what I've been hearing has been very encouraging. The fact is that the FCC policy of just leaving the CBers alone has worked out rather well. The CBers themselves have accommodated to the medium and many of the excesses of the past are that.

The sunspot minimum has helped the situation, of course. The ban on amplifiers has helped, too.

It's been ages since I've heard any bad language on CB . . . most of the contacts there are very friendly, ritualized and superficial . . . but they *are* radio contacts and it is a fact that millions of people are getting a taste of what radio can do . . . just a taste, mind you.

Whenever I hear an Amateur bad-mouthing CB I ask if he has used CB within the last year or so . . . the answer, without fail, is no. I haven't heard any CB users griping much about CB as it is today. I'm listening whenever I drive anywhere and find the road information of great value and many of the overheard contacts quite interesting. Most are not, naturally.

I may be wrong about all these people who are getting their feet wet for the first time in radio communications being prime material for conversion to Amateur Radio. I'll be most interested in hearing your luck with this . . . or lack of it.

Those CBers who are serious enough about the medium to get sideband gear seem to be particularly prime targets for Amateur Radio classes. It's something to think about.

The coming de-regulation of amateur radio may look a little less frightening to those who feel that stricter controls are needed rather than freedom if they spend some time operating on CB and seeing what a totally unregulated radio system is like and how amazingly well it works.

PC COPYRIGHT

Warning . . . if you are designing or manufacturing printed circuit boards you would do well to include a copyright notice on the board. More and more manufacturers are regretting this oversight as bogus boards turn up in their repair department . . . boards with their circuits on them, but obviously made by someone else . . . and poorly made.

Bill Godbout recently got a board in for repairs . . . he couldn't believe

EDITORIAL BY WAYNE GREEN

it, how could one of his boards be warped like that? A close inspection provided the answer: he'd been ripped off. I've seen rip-offs of Southwest Tech boards too, so there is a lot of that nonsense going on.

Warning . . . if you are going to buy a PC board, make sure you get it from the manufacturer if you are ever going to want help with repairs. The buck or two you save by greasing the palm of a rip-off artist may come to haunt you. Look for that copyright mark when you buy a board and watch out for flaky outfits . . . there are a lot of them.

FOREIGN LANGUAGE

My first brush with computer folk was when I decided to investigate the possibilities of an in-house computer for *73 Magazine*. I quickly found that the salesmen were unable to communicate with me. I turned to some ham-computer friends and found that they, too, spoke in computer language and were unable to interface with the English-speaking world.

What is it that happens to otherwise normal people when they learn to talk

in computerese? Seemingly they then forget what it was not to know this language and to be unable to further communicate with the non-computer world. Weird.

We need a lot of fundamental articles in *73* on microcomputers and their amateur radio applications, but we also need to have these written in either English or, worst case, ham language. One of these days someone is going to come along who has learned the computer field and still remembers that there was a time when he was not sure what software subroutines were ... and he is going to become rich and famous as an author. Well, famous, anyway.

73 SWEEPSTAKES WINNERS

As an experiment *73* ran a subscription sweepstakes contest last Fall with some attractive prizes. The idea was to create enough energy in subscribers to get them to send in renewal cards early and help us to save money by not having to send three and four notices.

The first prize was a windjammer cruise for two ... a ten day extravaganza of sailing, skin diving, swimming and possible DXpeditions among the rarer Caribbean islands.

The second prize was an Icom IC-230 with ac power supply ... and who couldn't use one of these ... or even two?

Third was a Chronex digital watch ... then a MITS 908M calculator, still one of the best of the breed and way above most of the hand calculators in useful functions.

Other prizes awarded were a cassette recorder, a digital clock for the shack, an ASCII output keyboard and many of the *73* books. In all there were 117 prizes awarded.

The windjammer cruise for two was won by P. G. Kaiper WA7UMF of Milwaukie, Oregon. Enjoy.

The IC-230 went to John Grubs W8GRT of Sylvania, Ohio. The Chronex digital watch was won by D. R. Krusza WB2IUD of Eggertsville, New York. The MITS calculator went to W6RDP in Canoga Park, California, the ASCII keyboard to C. P. Isbell K5EWC in Seguin, Texas, the cassette recorder went to Mickey Gallagher W6JRA of Colton, California and the digital clock for the shack to an L. Kushner of Burbank, California.

One of these days, when we get things organized again, we'll get another subscription renewal sweepstakes going ... hopefully on a regular basis. Right now things have been happening so fast that we are having a difficult time keeping up.

"GET OFF THIS NET FREQUENCY ..."

A nice front page article in the Columbia, South Carolina *The State* described how a local amateur (Henry Randall) helped save a Canadian boat headed from North Carolina to the Virgin Islands. The emergency call came in from VEØMCM/MM with three Canadians aboard and lost in a heavy storm for three and a half days and some 450 miles off course.

The call came while three locals were having a chat on 75 meters. Henry sat up with them all night and helped the Coast Guard find the lost boat and save the three men. All were suffering seriously from seasickness and were too weak to stand up. Two are, as of this report, still hospitalized and listed as in serious condition.

The medical advice passed along by Henry is credited with keeping the men alive until they were rescued. In all it was another of those amateur radio emergency situations to which all of us can point with pride.

Well, almost all. There was a chap in Florida who refused to give his call but who was very insistent that the emergency be moved down below 3900 kHz so he could conduct his net. This lid wouldn't shut up until someone took the time to explain to him in detail why *his* net frequency was being used for an emergency. I suppose we have to have one like that, right?

Thanks to WA4AIV for the report on the emergency and nice newspaper clippings of the amateur radio PR which resulted.

MOBILE NOISE

A nice article came in recently on mobile operating, but it had one striking omission ... there was nothing about how to get rid of the worst enemy of mobile contacts ... noise. Oh, there have been articles on this problem in the past, but car design is keeping up with and passing the old techniques.

The time was when you could easily isolate the spark coil and set about getting rid of ignition noise and things were cool. How many of you have looked into your engine compartment recently? I confidently raised the long hood of my Datsun 280Z ... hell, I've been at this for years, big deal there's noise in the FM rig ... and even worse noise on 10m ... as a matter of fact you wouldn't believe the 10m noise.

It didn't take me long to discover that something has happened to automobile design ... this car of mine is packed with cables going all over the place. I did find the coil, but I couldn't find the transistor oscillator which drives it ... and that seemed to be what was garbaging the 10m receiver. How could I get rid of the noise when I couldn't even find the main elements of the system? Oh, for wise guys who ask why I didn't get out the instruction book ... I did, have you looked at yours? Mine did not give any hint as to where any oscillator was located.

The dealer who sold me that car shook his head over the wild screeching noise coming out of the speaker. Seems he has a lot of customers with the same problem and he doesn't know anything to do about it. He did show me a big manual on the car and I managed to find the oscillator by tracking through the electrical system. The diagram was more complicated than most computer schematics.

Has anyone out there been able to quiet the cry of these newfangled transistor oscillators they're using to drive spark coils these days? I need to know and I'm sure a lot of others would like to know too. If I tell you something confidentially you'll not be angry and keep back the mod for quieting my monster, will you? I lied. That wasn't 10m where I had all that noise ... it was 11m.

INSTANT CODE?

Well, almost. The fact is that it is possible, using recently discovered techniques, to learn the code in a fraction of the time most of the old timers had to devote to it. It isn't yet completely painless, but a whole lot of the sting has been removed.

Funny, the modern system not only works, it makes sense, too! About the only thing wrong with it is that it flies in the face of about 50 years of teaching in the handbooks and license manuals.

Any old timer will tell you that to learn the code you have to start slow and then pick up speed as you learn. You *can* learn it that way ... if you're got lots of time and patience. That system has defeated an awful lot of prospective amateurs who didn't have the patience it took to do it that way.

Think about it for a moment. The whole idea is to train your mind to automatically recognize a sound pattern and have your hand write a letter. It's not much different from a lot of other patterns we teach ourselves ... tying shoes, driving ... playing an instrument. But what happens to the learning process if we keep changing the sound patterns we are trying to pattern into the mind? Morse code at five words per minute doesn't sound anything at all like eight or twelve words per minute. What we have been doing in the past is learning to copy at one speed, then another, and another ... driving ourselves unnecessarily crazy.

The modern system is to learn the sound of the characters at the speed you want to copy and just space the characters to give the mind time to work. Even at five words per minute each character should be sent at the desired 13-per. This will cut a hundred hour back-breaker into a ten hour jaunt.

Now, with over 25,000 of the *73* code tape cassettes using this system in use, and with most of the club-organized classes using the *73* code cassettes, few prospective amateurs are having to slave away with the old system ... thank heavens.

The whole cassette project came from my effort to find out which code teaching system was best so I could recommend it in the magazine. After reviewing everything I could find, I decided that none were what I considered up-to-date. I talked with a couple code tape people and asked if they had any plans to modernize ... no. So I said what the hell and sat down and made my own master tapes. It was a grueling experience turning out a solid hour of absolutely perfect

code without variation in speed. Try it sometime, you code freaks.

The cassettes now available start with an introductory one hour tape that teaches the 40 characters you need to know . . . letters, numbers and punctuations. Many people get them in an hour. For those going for Novice or Tech there is a six word per minute tape, one hour of gibberish, unmemorizable. Those made of sterner stuff can go right to the 14 word per minute tape. It's slow going at first, but then things fall into place and instead of copying at five, six, seven, eight, etc., you find you are copying at 14! And you also may notice that the old hump at ten words per minute just isn't there.

The hump was the painful result of finally being forced by the speed of the code to stop translating and, at long last, get started where you should have in the first place . . . automatic copying. Everything before the hump was wasted. Some people, with monumental effort, are able to translate code . . . listen to the character and then remember what it is . . . right up to almost twelve words per minute. At this time the speed of the brain won't hack it further. It's so much more difficult that it is a real pity when people get into that bind.

For speed demons I have a 25 wpm tape. Canadians may prefer the 10 wpm tape. Extra Class devotees will want the 21 wpm practice tape. I've never heard of anyone failing the FCC exam when they could copy this tape.

The major problem in copying code for the FCC is overcoming the panic of the test. By setting the speed on the tapes a bit high I've found that this margin is enough to bring on a giant sigh of relief when the code test starts . . . it sounds so slow compared to the tape that all fear disappears and the whole thing is a piece of cake. The FCC tests are in relatively plain language too, which gives you an extra margin since the tapes are in cypher to prevent memorization.

OSCAR CONTACT

After noting the low level signals of Oscar 7 in mode A and the beautiful signals in mode B, I could see which way I should go. But there were some serious technical problems between wanting to get on via Oscar and actually getting on the air. You don't yet go out and buy a 432 sideband rig to poke that signal into Oscar.

The downlink was not much of a problem. I got a KLM two meter circularly polarized beam for starters. Then came the Vanguard converter to be mounted up at the antenna. That should do it. About that time my Signal One gasped and emitted a very expensive smell. That was going to be my downlink receiver on 10m. Panic . . . eased by some promises by ITC (which was the manufacturer of the rig) to fix it. This later was changed to a deal whereby we would get a couple of their Multi-2000s in exchange . . . not quite as good as the converter into a hot 10m receiver, but usable. We're still waiting for the Multi's . . . or the Signal One . . . or *something!*

Tucker had an old Yaesu 560 in good shape so we bought that and put that into the line as a receiver. Oscar came in fine on this once the antenna was in place. That was half of the project . . . well, considering the complexity, that was 1/10th.

After a good deal of digging around I located an outfit in California which made 28-432 MHz tube type converters ($140) . . . and I got one. This meant a second 10m rig to use as an SSB generator with about one Watt output to drive the converter. My Atlas wouldn't hit the right part of the band so I ended up borrowing a Ten Tec Argonaut from Tufts Radio . . . bless Tufts. The converter only had about five Watts output, not nearly enough to tickle Oscar, particularly after going through a hundred feet of coax and a phasing section.

Sensing that I was going to need more than a little help with this whole matter I enlisted Sandy Cole W1PVF who drove up from Boston not a few times to work on the antennas, the equipment, the rotators and the feedlines. As things got closer to fruition Chuck Martin WA1KPS and Joe Polcari WA1PQE swung into action, digging up power supplies to run this and that, spending hours on the roof changing the feedlines and the connectors.

In line with needing more power at 432 MHz, I contacted TPL and eventually ended up with a not inexpensive 432 amplifier. Not inexpensive at all. But nice.

After checking out the system and getting it about ready to go, Chuck, Sandy and Joe came up one Sunday and spent the better part of the day getting everything ready. Oscar was due over in mode B at 8:10 pm according to our figures. We adjourned for a leisurely dinner at a nearby restaurant and then headed back to the shack, an hour in hand.

Chuck decided to check out the antenna rotating system . . . the pass would be almost directly overhead. He swung the beam upward and it stuck! Ooops. The three of them headed to the roof with a hack saw to hack off the back end of the antenna boom that was hitting the chimney, preventing the 180° swinging of the antenna vertically . . . then they needed a 10' step ladder . . . quite a deal in the black of night in November on top of a sharply peaked roof. With minutes to spare and much coordination on 52 via HTs the antennas were ready to go and the rig fired up.

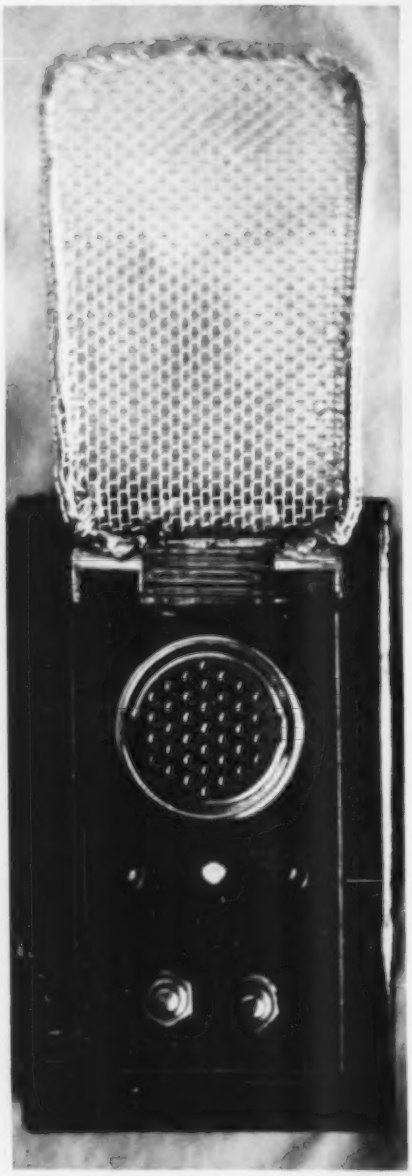
Picture four people all tuning for signals, trying to grab the mike and zero in on received signals. There were several minutes of arms, legs, body language, and grunting before my persistence won out and I managed to get momentary control of both the transmitter and the receiver . . . and get a contact with WA6UAP . . . 5x5, he said. I gave him a 5x7. It was exciting. We'd made it.

Continued on page 144

Chuck WA1KPS, Joe WA1PQE and Sandy W1PVF work to get the 73 Magazine *Oscar antennas into orbit.*

Trekkies, Build this Starfleet Communicator!

by
Marc I. Leavey, M.D. WA3AJR
10-J Tentmill Lane
Pikesville MD 21208



TOP SECRET
CLASSIFIED

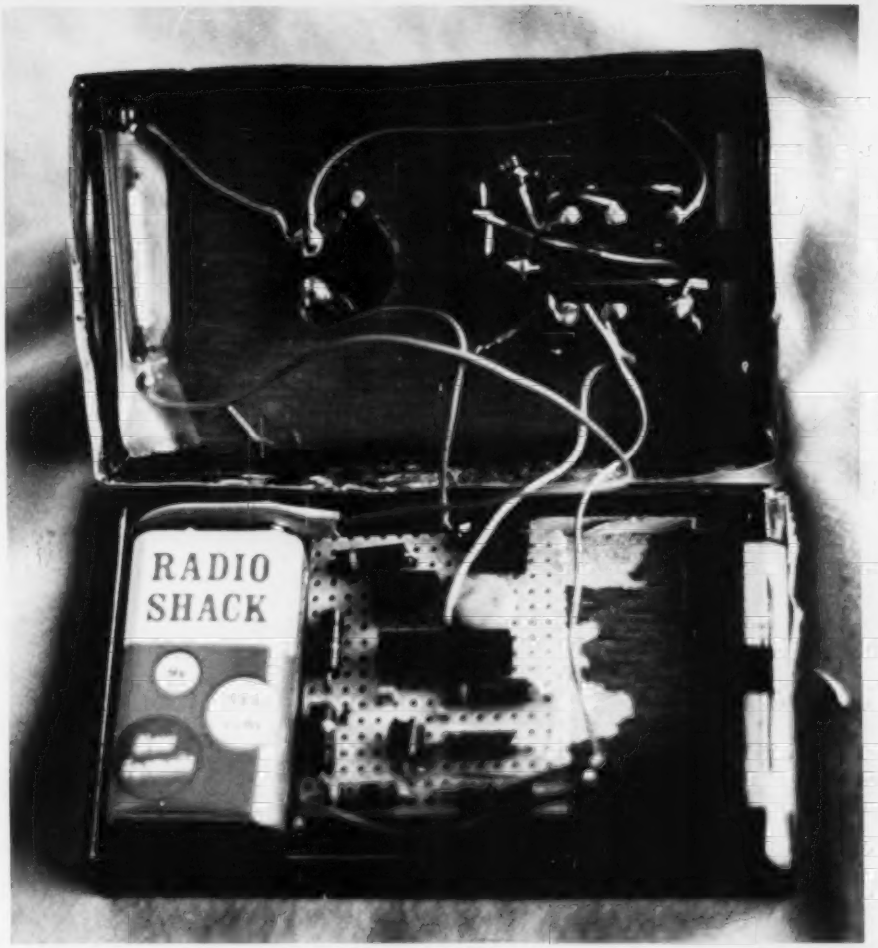
FOR COMMAND LEVEL USE ONLY

The plans contained herein are drawn from data in storage at Starfleet Archives, UFP, and are released for information only. Operation of communications devices within this sector of the galaxy is restricted under UFPCC regulations to authorized individuals only.

"Star Trek," a television show popular in the late 1960s, spawned a cult of followers that cannot be believed. There are Trekkies in all walks of life, particularly among college students, electronic engineers, doctors, and, it is hoped, hams. There are books, models, and national organizations devoted to perpetrating the culture of the United Federation of Planets. In this vein, I have designed and built a functional model of a Starship communicator.

The Communicator, as any dyed-in-the-wool (or velour) Trekkie knows, is the all-purpose, futuristic HT carried by all landing party personnel. Besides a basic, long range transceiver, the communicator also contains a transporter beacon for beaming up and an emergency distress signal for urgent transportation. This version, designed after the TV model, has all of these features.

On the front panel, there are the speaker/mike, three LED function lights, and two control switches. A hinged lid covers the controls, which serves the dual function of on/off switch and antenna. The



LED function lights represent ON (Green), HIGH POWER (Yellow), and EMERGENCY (Red). Two push-button switches control the HIGH-LOW power function, and the EMERGENCY beacon. Opening the Communicator lid not only turns the unit on, but produces the characteristic series of blips which identifies the hand-held device.

The circuit, shown in Fig. 1, is for the basic pulse generator that supplies the effects for the unit. The unijunction transistor is used as a simple oscillator, the output of which is fed to a 7493 4-bit binary counter. Four pulses are derived from this, in a one-half second gate, and fed to a 555, connected as an audio oscillator. The output of this goes to a speaker.

The complete communicator schematic is illustrated in Fig. 2. The LEDs are wired in series with the pulse generator, and no series resistors are needed, as current is effectively limited by the pulse generator. A 200 uF capacitor is needed across the battery to bypass internal resistance. Two SPDT push buttons are wired with the LEDs. One alternately selects the Green or Yellow LED, to represent LOW or HIGH power. The second switch normally shorts the Red LED. When depressed, the short is opened, lighting the LED, and a current is delivered to pin 4

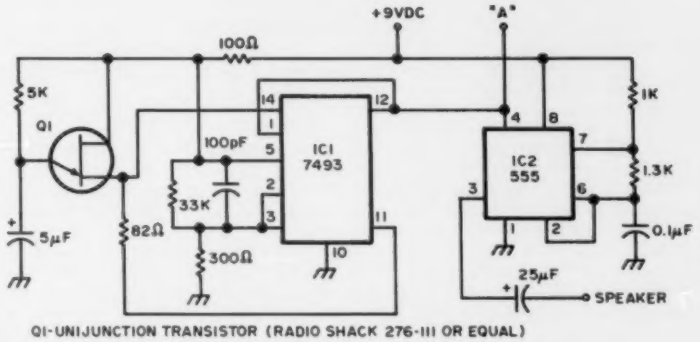


Fig. 1. Basic pulse generator.

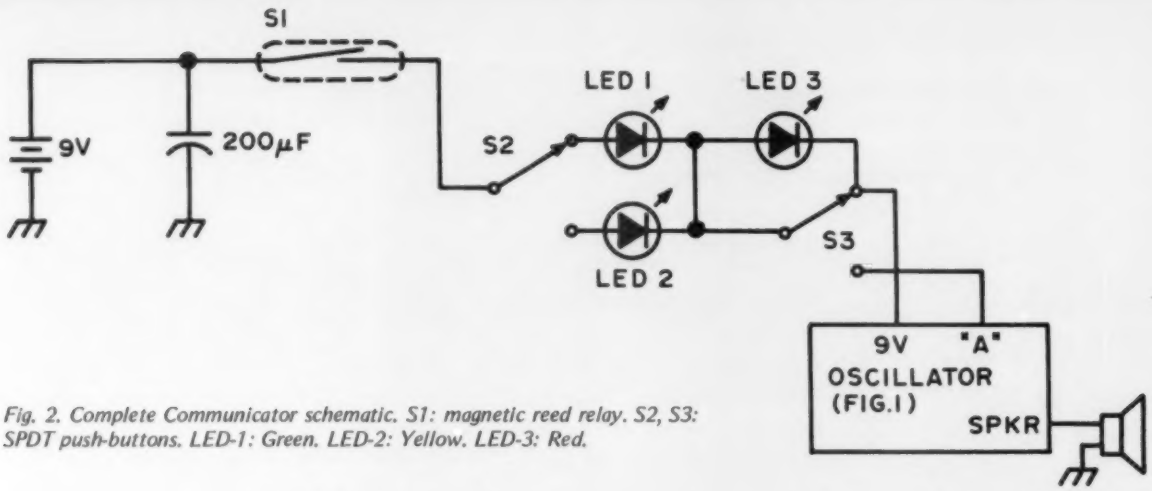


Fig. 2. Complete Communicator schematic. S1: magnetic reed relay. S2, S3: SPDT push-buttons. LED-1: Green. LED-2: Yellow. LED-3: Red.

of the 555, triggering a continuous oscillation.

Several techniques were tried for turning the communicator on when the lid was opened. The method finally settled upon was the use of a magnetic reed relay under the cover, with a small bar magnet mounted on the antenna lid.

Mechanically, the device is constructed in an appropriate sized, small wooden jewelry box. Such boxes are universally used by jewelers for necklaces, etc., and one can usually be scrounged from a wife or girlfriend. The speaker is a small, surplus earphone. Suitable types are available widely for a couple of dollars. A snap-in pipe bowl screen, with the snaps removed, serves as a miniature speaker grille. The LEDs are press-fit into the front panel, and the switches mounted conventionally. Fourteen-gauge wire is bent into a rectangle and covered with window screening for the antenna lid. Two rings from the center of a cheap ballpoint pen are soldered to one side, and the assembly mounted on a plastic tube, acquired from an old Bic pen. A small spacer glued to the bottom of the tube serves as a mount, and to keep the antenna assembly from slipping off. In order to activate the hidden reed relay, a small magnet is glued to the antenna, near the hinge. All of the electronics fit comfortably onto a 3 x 5 cm piece of perfboard, with the wiring done point-to-point. Detailed construction is left to the builder, but, with reasonable care, the finished result should delight any Trekkie.

I would like to extend sincere thanks to Robert Glaser WA3MSW, who aided immeasurably in the construction of the communicator. We would like to note that construction has been started on a small transporter. A shortage of dilithium crystals, however, has stalled the project. Any reader with an adequate supply is invited to write to the above address. ■

OPERATION INSTRUCTIONS
FOR
SF MOD. 6272 HHC

1. Stand in a reasonably clear area for transmission.
2. Open the unit with a gentle flick of the wrist.
3. Production of several coded blips and illumination of the green telltale indicate the unit is functioning and ready for use.
4. Speak clearly into the speaker/mike, remembering that this device has an instantaneous voice operated transmit and receive circuit.
5. If receiving station complains that your signal sounds weak, boost power by depressing the left push-button. The yellow telltale indicates high power operation. USE MINIMUM POWER TO GET THE MESSAGE ACROSS!
6. FOR EMERGENCY USE ONLY: Depress the right push-button. The red telltale comes on, and the automatic beacon is activated. When the button is released, the telltale extinguishes to conserve power, but the beacon is continuous. Assume transport position; beam-up should commence within 30 standard seconds.
7. This device is limited to one parsec communications range. As long as a Federation vessel or receiving monitor is within that range, communications will be possible.

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Synthesized receivers are gradually appearing in the marketplace. Their numbers will increase as the cost of complex ICs drops. They all operate basically the same, using the phase lock loop (PLL) technique of generating L.O. (local oscillator) frequencies. One crystal is used to generate the whole range of L.O. frequencies – each frequency as accurate as the crystal.

Here's a project that will provide you with several precise (.005%) frequency standards and also get you familiar with phase lock loops.

The heart of this unit is the NE562 phase lock loop. Internally it has a phase comparator, adjustable low pass filter, a VCO (voltage – controlled oscillator) and two outputs. It also has provisions for inserting a programmable divider between the phase comparator and VCO, thus permitting frequencies to be changed.

The frequency range of this device is 1 to 10 MHz in 1 MHz steps, with an accuracy of .005% at each frequency (greater accuracy is possible with a closer tolerance xtal). The output is a symmetrical square wave at each frequency that is useful as a scope timebase calibrator, checking bandwidth and frequency response of HF amplifiers, calibrating communication receivers with the 100 kHz output, or as a "clock" for future IC projects.

All of the ICs (including the NE562) are readily available from electronic mail order houses. The remaining few parts you can get from your junkbox. They are all "or equivalent."

How It Works

Before we get into the details of construction, a little basic operation of phase lock loops may be helpful. A basic phase lock loop consists of a phase comparator, a VCO and a low pass filter, as shown in Fig. 1.

The phase comparator (or phase detector) has two inputs, the reference frequency and the output of the VCO. The output of the phase comparator is a dc control voltage proportional to the phase difference between the two input frequencies. The control voltage equation is $V_C = K(\Theta_{ref} - \Theta_{VCO})$ where K is a constant in volts/radian and $(\Theta_{ref} - \Theta_{VCO})$ is the phase difference in

A Synthesized IC Frequency Standard

radians. Now the VCO frequency is controlled by a dc voltage. As the frequency of the VCO tends to drift, a phase error develops and is fed back to the comparator which compares it with the reference signal and produces a dc voltage that changes the frequency of the VCO in the direction that will reduce the phase error. Since the VCO is controlled by a dc voltage, any ripple on the voltage will FM (frequency modulate) the VCO. That's the purpose of the low pass filter between the phase comparator and

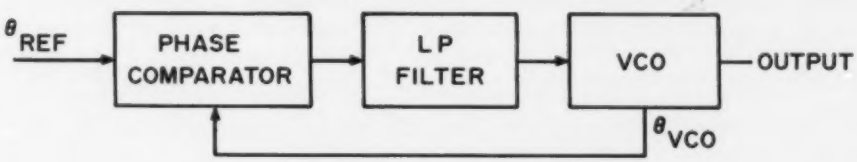


Fig. 1. Basic phase lock loop.

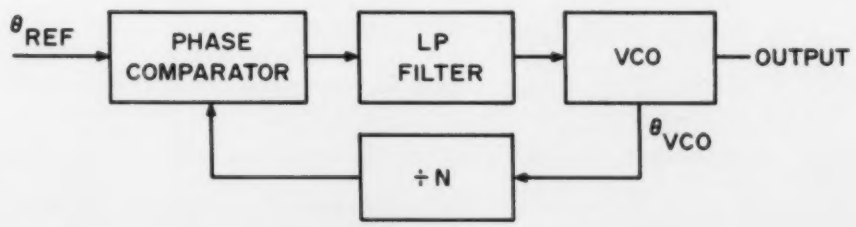


Fig. 2. Variable divider added to basic phase lock loop.

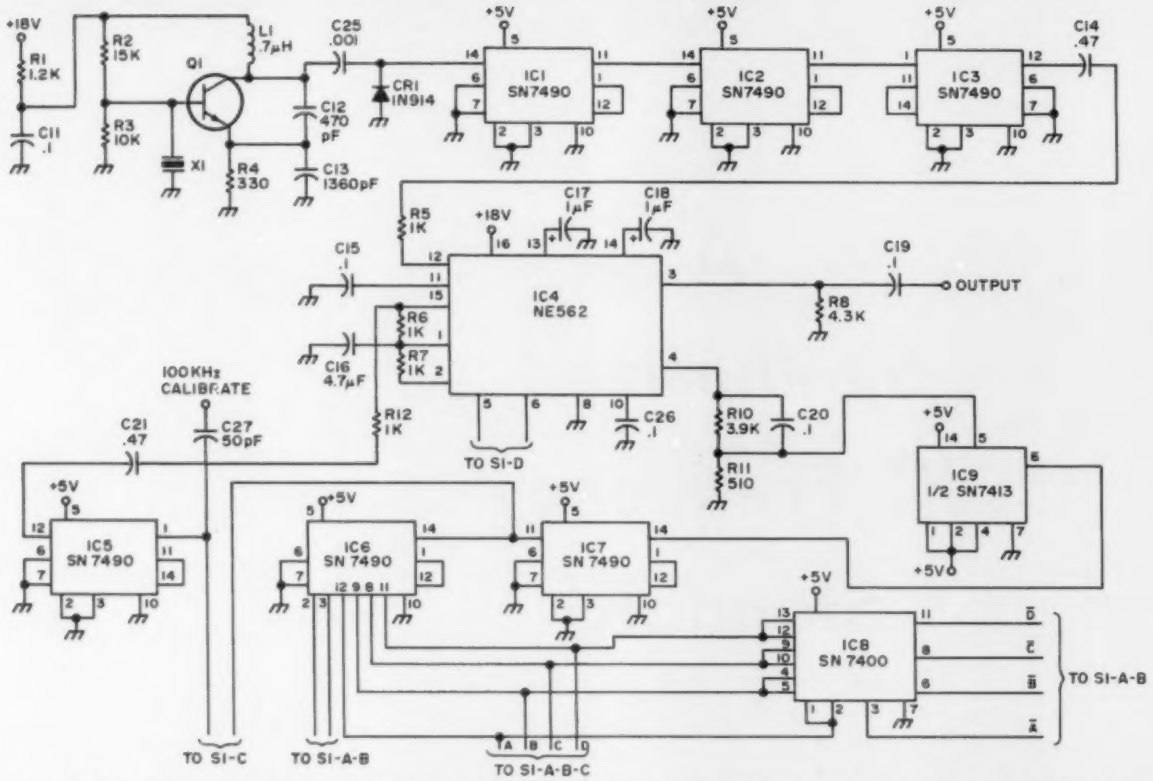


Fig. 3. Schematic diagram. R1-R12 – ¼ Watt carbon resistors; C11, C15, C19, C20, C25, C26 – 20 V disc; C12 – silver mica Elmenco DM19; C13 – silver mica (2 – 680 pF in parallel) DM19; C14, C21 – 35 V Sprague type 196D, 474X0035HA1; C17, C18 – 35 V Sprague type 196D, 105X0035HA1; IC1, IC2, IC3, IC5, IC6, IC7 – SN7490 decade counter; IC4 – NE562 phase lock loop; IC8 – SN7400 NAND gate; IC9 – SN7413 NAND Schmitt trigger; Q1 – 2N5172; X1 – 10 MHz .005% crystal (series resonant) from Jan Crystals, 2400 Crystal Dr., Ft. Myers FL 33901; L1 – .7 microhenry inductor; S1 – rotary switch 4 pole 10 position, Centralab PA-1015.

VCO, to reduce this ripple. It also helps to set the capture range of the loop.

One drawback of Fig. 1 is that it will only work at one frequency. The output frequency is the same as the reference and there is no way to change the frequency. If we put a variable divider (÷N) between the VCO and the phase comparator feedback path, we can vary the frequency of the VCO, then divide it down so that the phase comparator inputs are always the same. This allows us to change the VCO yet maintain the same inputs to the phase comparator. See Fig. 2.

The control voltage equation now is:

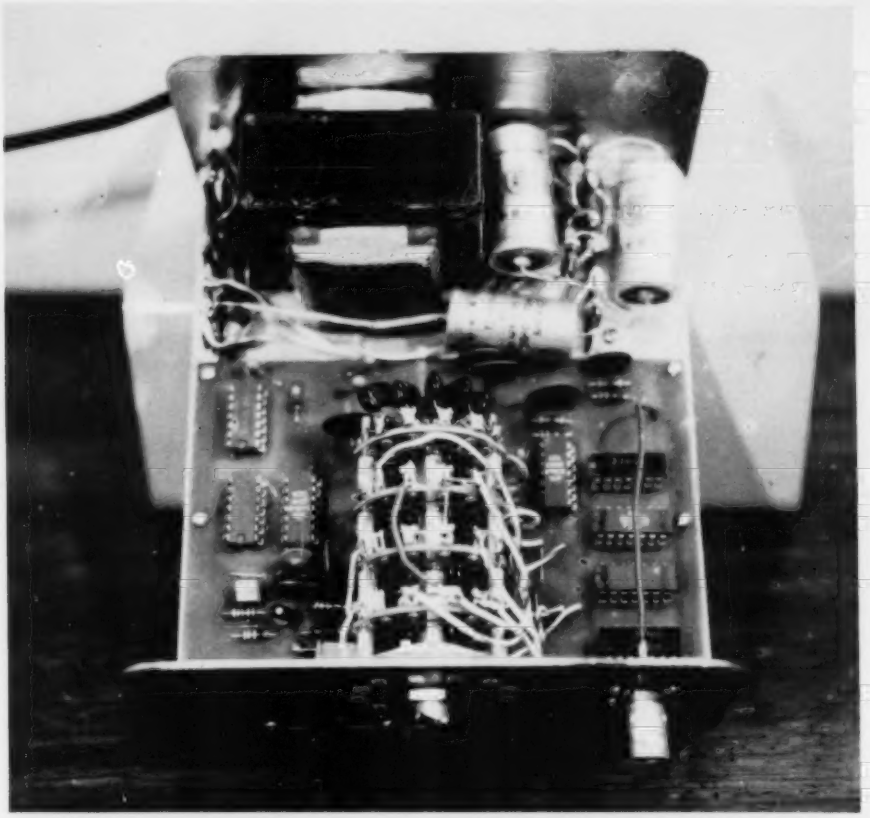
$$V_c = K\left[\Theta_{ref} - \frac{\Theta_{vco}}{N}\right]$$

where N is the number programmed into the variable divider. The operation of this system is the same as the basic loop described above.

The Reference Circuitry

The circuitry of Q1 is a 10 MHz .005% crystal controlled oscillator. R2 and R3 is the bias network. C12 is the feedback capacitor and is part of the resonant tank along with C13 and L1. If you don't have a .7 uH inductor for L1, you can make your own by winding 19 turns of #30 magnet wire (closewound) on a 1/2 Watt resistor (100k or larger). C13 is 2 680 pF capacitors in parallel. X1 is a 10 MHz .005% (series resonant) crystal.

C25 is a coupling capacitor to the following IC. Normally, a shaping circuit would be included here. But the rise and fall times at 10 MHz are adequate to trigger the IC. We will need a diode though (CR1) to clip the negative going transitions and prevent V_{eb} breakdown in the IC. IC1, IC2, and IC3 are wired to divide by 10. The output of IC3 is at 10 kHz. This will be the reference signal for the phase comparator. You'll note that IC3 is wired a little differently than IC1 and IC2. This is done so that a symmetrical 10 kHz square wave is fed to the comparator. R5 reduces the drive level into the comparator.



The Programmable Divider Circuitry

Pin 4 on IC4 is one of the VCO outputs. R10, R11 and C20 couple the signal out while still maintaining a dc path for the emitter in IC4. This signal is fed into IC9 which is 1/2 of an SN7413. The SN7413 is a dual Schmitt trigger. A Schmitt trigger improves the rise and fall transitions over a wide range of input frequencies. Since the output frequency changes from 1 to 10 MHz, suitable transitions are necessary over the full range of frequencies to insure positive triggering for the following IC. IC7 is a prescaler. It divides the output of the VCO by 10. This was done so that the programmable divider following (IC6) will operate at a lower range of frequencies, from 100 kHz to 1 MHz. Propagation delays and race conditions can cause false triggering at high frequencies. IC6 is the programmable divider. This is where all the switching of the system takes place. Basically, we want to divide all frequencies out of the VCO so that the output of the programmable divider is always 100 kHz. For example, if the VCO is at 5 MHz, the prescaler reduces it to 500 kHz and the programmable divider is switched to ÷5 and the output is 100 kHz. If the VCO is at 9 MHz, the programmable divider is switched to ÷9 and the output is 100 kHz. IC6 can be switched from ÷2 to ÷9. Now at 1 MHz the output of the prescaler is 100 kHz. We don't need the programmable divider here so it is simply bypassed. The output of IC6 is further divided by 10 in IC5, wired to provide a symmetrical 10 kHz square wave out. R12 is the same as R5, to reduce the drive to the phase comparator. R15, CR2 and CR3 are part of the ÷7 decoding. CR2 and CR3 can

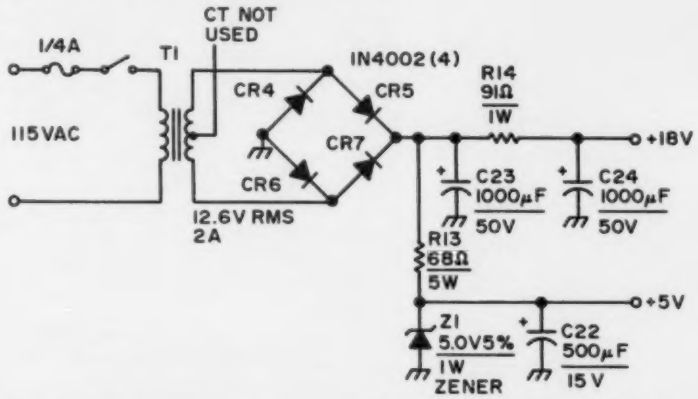


Fig. 4. Power supply. R13, R14 – carbon resistors; C22 – 15 V; C23, C24 – 50 V; T1 – 12.6 V rms power xfmr Allied 6K36HF; Z1 – 5 V ± 5% zener diode 1N4733A; CR4-CR7 – 1N4002 (PRV 100 V, 1 A).

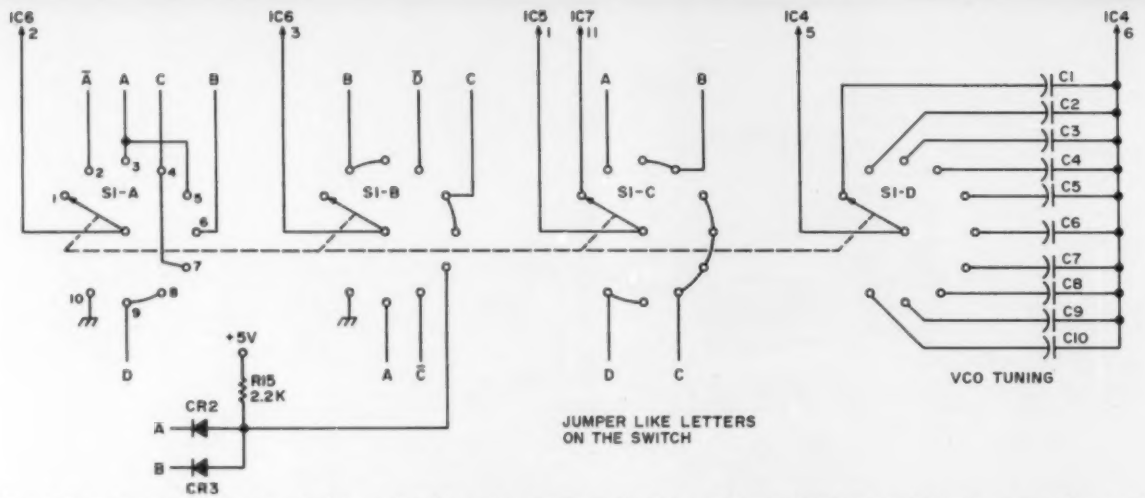


Fig. 5. Programmable counter switching and VCO tuning diagram. C1-C10 – Elmenco DM10 or DM15 silver micas (see text); CR2, CR3 – 1N118 (germanium).

be any general purpose *germanium* diodes. IC8 inverts the A, B, C, D outputs of IC6 to provide the $\overline{A}$, $\overline{B}$, $\overline{C}$, $\overline{D}$, outputs to decode the programmable divider.

So now we have described the development of the two input signals to the phase comparator, one signal as a fixed reference (Θ_{ref}) and the other containing the phase error information (Θ_{VCO}) from the VCO.

Pins 5 and 6 on the NE562 (IC4) are provided for capacity tuning the VCO. As each frequency is switched, the capacitor across pins 5 and 6 has to be switched. The free running frequency of the VCO has to be tuned within the capture range of the loop. As mentioned earlier, the low pass filter determines the capture range of the loop. C17 and C18 on pins 13 and 14, respectively, on IC4 are the low pass filter capacitors. When the free running VCO is tuned within approximately 300 kHz of center frequency, the loop will lock. The following chart gives the approximate tuning capacitors for F_c at each frequency. They should all be silver mica.

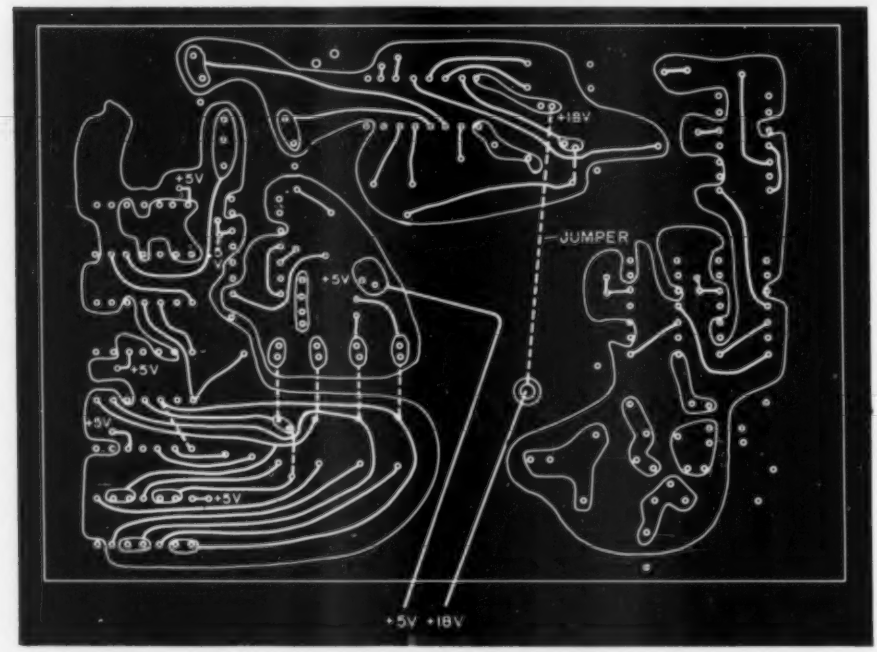


Fig. 6. PC board.

C1	300 pF
C2	150 pF
C3	100 pF
C4	68 pF
C5	50 pF
C6	43 pF
C7	39 pF
C8	33 pF
C9	30 pF
C10	27 pF

Construction

Except for the power supply and divider-frequency switch, all the parts are mounted on the 3-7/16" x 5" etched PC board. Holes are provided on the board for all the wires going to S1. Sockets can be used for all the ICs to simplify troubleshooting, if necessary, or they can be hard wired to the board. I used the Molex terminals available at electronic stores.

They're inexpensive and are satisfactory sockets. Holes are also provided to strap all the IC power connections. Use magnet wire. Several circuit jumpers are also needed as shown on the parts layout. C1 – C10 should be mounted right on the switch (S1), with all the common points brought together in the center. Run a wire to the circuit board.

Final Checkout

Before applying power, check that all the jumpers are in and the ICs are mounted in the correct positions. Set the frequency switch to the 1 MHz position. After you're sure everything is OK, apply power and check that the supply voltages are present. +18 volts should be at the junction of R14 and C24. R14 can be changed to make it +18 volts. +5 volts should be at the zener diode. A counter would come in handy here for the following check but a scope will do. A triggered scope is even better. At the junction of C14 and R5, there should be a 10 kHz square wave approximately 3 volts peak to peak. This one point checks that the oscillator is working and also the divider chain. The same wave shape should be at the junction of C21, R12. If it is, the loop is locked at 1 MHz .005%. Repeat the above for each position of the frequency switch. If you reach a position where both wave shapes are not the same, check the switch wiring of the programmable divider. If it's alright, you'll have to adjust the tuning capacitor for that particular channel. Calibrate the scope using the reference 10 kHz signal. Display one square wave for 10 cm on the scope (junction C14, R5). Move the probe to the junction of C21, R12 and adjust the tuning capacitor until the same wave shape appears.

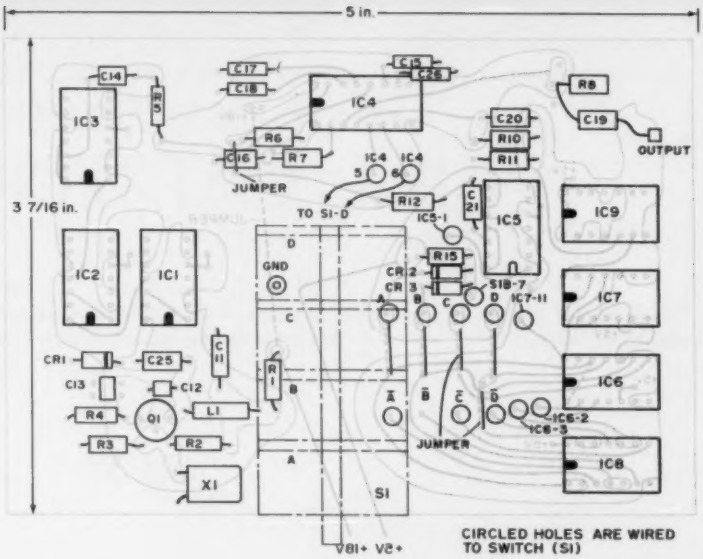


Fig. 7. Parts layout.

If the output is to be used as a "clock" to drive TTL circuitry, the circuit in Fig. 8 is suggested.

Use low capacity cabling on the output if you're going to run it any distance to preserve the wave shape. With the front panel switch in the 2 MHz position, a symmetrical 100 kHz signal is available on the front panel for calibrating communication receivers; simply couple the output (loosely) to the antenna input. ■

Miscellaneous Parts List

3½" x 5" copper clad board
Aluminum box
Line cord
On-off switch
Connector
Misc. hardware
ICs available from: B&F Enterprises, 119 Foster St., Peabody MA 01960; or Solid State Systems, P.O. Box 773, Columbia MO 65201.

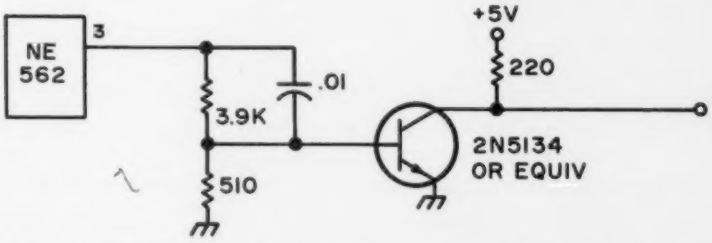


Fig. 8. Output circuit to drive logic. (Note: Circuit from Signetics Handbook.)

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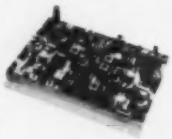

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PA220/15 Kit .	similar to PA144/15 for 220 MHz	39.95
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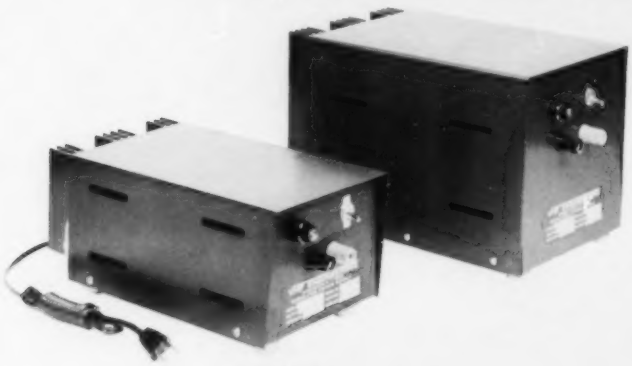

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Size:
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Current Output:
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20 amps continuous
Ripple:
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Weight:
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You Can Make Photo PC Boards

by
John Harrington
5132 Marcella Avenue
Cypress CA 90630

Construction of high-quality printed circuit boards, unfortunately, has never been a simple matter. Over the years, having made hundreds of boards, I have tried many methods, some simple, some complex, some cheap, some expensive, with varying degrees of success. The method described here has been in use for over a year now, and I am very pleased with the results. It allows me to make any desired number of high-quality boards with minimum expense and effort. Although there is nothing "new to the art" here, the method described for making negatives is one which I haven't seen described in amateur literature.

The steps to follow to make the boards are as follows:

1. Make up the "master artwork."
2. Prepare a negative from the artwork.
3. Clean and photo-sensitize the copper-clad board.
4. Expose the board through the negative.
5. Develop the exposed board.
6. Etch the board.
7. Plate the board if desired for corrosion resistance and appearance.

Don't let the imposing-looking list above discourage you – each step, in itself, is simple, and with reasonable care, is goof-proof. Let's take the list one at a time.

Preparing the Artwork

Start with a generous size sheet of transparent mylar or acetate sheet, about a centimeter bigger on each side than the size of the board you wish to make. If you are copying a published circuit which has full-size layouts, just stick the mylar down with masking tape over the published circuit. Then, using either india ink or commercial prepared patterns and tape, trace the circuit onto the mylar. If you are designing your own layout, tape the mylar sheet down on a piece of grid paper with 1/10" line spacing. This is very helpful as a device to keep your lines straight, and keep the component spacing and layout optimum. Most ICs and many other parts use lead spacing which are multiples of 1/10 of an inch – the grid paper makes it easy to locate component leads precisely on the layout. I use commercially available opaque sticky tape for conductor lines and component pads. Try to arrange the components to minimize the number of crossovers – sometimes a simple re-arrangement will eliminate several cross-overs.

When the layout is finished, check it against the original artwork or schematic to be sure it is correct. Don't overlook the fact that your layout is a *bottom view* of the

completed PC board, so your component pins must be connected properly for a bottom view. Be particularly careful with ICs – the manufacturer's drawings generally identify leads with a top view. I find it very helpful to redraw the IC on a scratch pad showing the bottom view of the pins and refer to it while drafting the circuit. This really helps when you are trying to cram ten or fifteen 14 or 16-lead ICs in a small layout. If you find you have made a mistake, just peel off the incorrect pattern and stick down a new one. If you are using india ink and wish to change the circuit, the easiest way I have found is to stratch off the incorrect part with the blade of a sharp knife, being careful not to damage the mylar. Then, redraw the circuit.

Preparing the Negative

To do this operation, we will expose some photographic film to light through the artwork. This is a darkroom technique, so it needs to be done under a "safelight." A safelight is simply a common lamp with a filter over it which only allows certain colors to pass through. These colors are chosen for their wavelength; the film we will be using is relatively insensitive to red light. Therefore, we can use a red filter and illuminate the work area without danger of ruining the film.

In use here is an inexpensive safelight holder with a Kodak 1A filter, and a 25W household bulb. With this mounted over the work area, it will provide plenty of illumination to clearly see each operation.

Inexpensive lithographic black and white film is used for several reasons. It is a relatively "slow" film which means it takes more light for a longer time to expose; therefore, it is much more forgiving of errors such as outside light leaking into the darkroom or overexposure. This type of film is especially designed for high contrast. Also it is easy to obtain this film at most any photo supply shop, and the cost for a piece of 10.1cm x 12.7cm (4" x 5") film is about 10¢.

Exposing the film is best done in a "contact frame." This can be as simple as sandwiching the artwork and film between a piece of flat black paper and a piece of clear glass. The glass serves only as a weight to hold the artwork and film in close contact to keep light from leaking under the black portions of the artwork. A more elaborate contact frame can be constructed or bought, but will only make the work more convenient, not better. I use a 150W flood light for exposure at a distance of 61cm (2'), and a 2-second exposure time, using my wrist watch and my finger on the light switch for timing. The two chemicals for development can be bought at the same store as the film. The developing bath I use is a 2-part solution which is mixed together in equal quantities just before use; the unmixed solutions can be stored for long periods without degradation. The "fix" solution can even be reused over and over again, by storing it in an air-tight bottle, but it is so cheap that I use fresh solution each time. The developing bath, however, must be discarded after a couple of hours use, as its performance degrades rapidly with use. Follow the manufacturer's directions when mixing the chemicals from the packages. You will need three developing trays, of a size sufficient to hold the film under the solutions. These are generally shallow black plastic trays and are very inexpensive.

Prepare the trays as follows: line up the trays, side by side, about 15.5cm (6") apart. These trays, from left to right, are for developing, washing and fixing. Pour equal quantities of the 2-part developing solution into the developing tray until it is about half full. Then half fill the wash tray with ordinary tap water. The fix tray is half filled with the fix solution.

Now we are ready to make the negative. Cleanliness is very important in any photographic work – dirt or dust smears can show up on your completed work. Turn on your safelight and extinguish all other lighting. Open the package of film and carefully open the light tight inner container. Take out a piece of film and immediately close up the package again so you won't forget later. Take a good look at the piece of film, handling it only by the edges. You will notice that one side is shiny, while the other

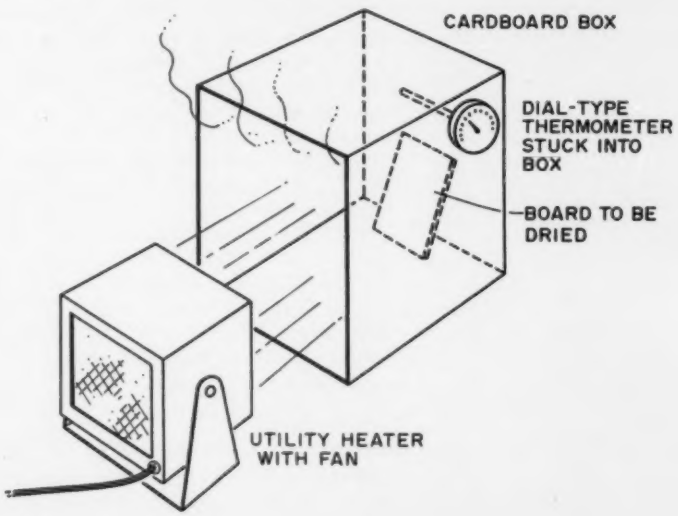

Fig. 1.

ARTWORK AND PHOTORESIST MATERIALS

1. G. C. Electronics, 400 South Wyman St., Rockford IL 61101, offers a free catalog of the full G. C. line of components and chemicals.
2. Bishop Graphics, Inc., 7300 Radford Avenue, North Hollywood CA 91605 offers a catalog of drafting aids for quantity users.

Many ham-oriented electronics supply houses have G. C. displays with all necessary materials to make everything except the negatives.

Ferric chloride can be obtained in gallon quantities at many electronic or chemical supply houses.

Hydrochloric acid for etchant rejuvenation can be obtained from chemical suppliers or drugstores.

has a dull finish. Place the dull side down in your contact frame. Then put your artwork down on top of the film, centering it carefully, and place the clear glass cover down on top of that. Expose for approximately 2 seconds at a distance of about 61cm (2'). Open the frame and extract the film. Place the exposed film in the developing solution, shiny side up and rock the tray slightly to agitate the solution. After a few seconds, depending on the temperature, you will see the image start to form on the film. When the image seems to be fully developed, wait another 10 or 15 seconds. Then reach in and grab the film by the edge and pull it out. Let it drip for a few seconds, and then, still holding it by the edge, slosh it around in the wash solution (water) for about 30-45 seconds. Pull it out, let it drip and place it in the fixer. Rock the fix tray slightly to agitate for about 5 minutes. After the first couple of minutes in the fix tray, you can turn the normal room lighting back on. The final step is to wash the completed negative off in warm running water for a few minutes and hang it up to dry. At this time, hold the negative up to the light and look it over. The black areas should be really opaque, and the clear areas should be perfectly transparent, with no smearing or fuzzy lines. A little experimentation with exposure and development times will optimize your particular setup. Frankly, I was amazed at how easy and non-critical this process is, using lithographic film, compared to the elaborate setups used to expose and develop high-speed color film that requires total darkness, careful temperature control and precision timing of various steps. My workshop is in my unheated garage, and I have made beautiful negatives when the ambient temperature was as low as 60° F. The chemicals work a little slower at low temperatures, so just develop slightly longer.

Sensitizing the Copper-clad Board

While ready-made photo sensitized boards can be purchased, it is much cheaper to do it yourself. The photoresist is made by many different companies, but about the most convenient and easily obtained is a spray can made by G.C. Electronics. This resist is most sensitive to the ultraviolet portion of the light spectrum, so a common yellow "buglight" can be safely used for the safelight. Also you will need some means of drying the board after cleaning, and after spraying on the photoresist. A simple forced air oven can be made by blowing hot air from a small electric heater into a cardboard box — this is the method I use, see Fig. 1. Monitor the temperature in the box with a thermometer. The first step is to thoroughly clean the copper-clad board. Scrub it with steel wool soap pads, using plenty of water, until the copper is bright and shiny. Test for cleanliness by letting water flow across the surface — dirt or fingerprints will make the water "bead" or "break." It is very important to have the copper surface clean to insure that the photoresist will adhere properly. After cleaning, and for all subsequent operations, handle the board only by the edges. Wipe the board with a clean, lint-free rag, and place it in your "oven" to dry. Dry for about 20 minutes at 100 to 115° F, then remove and let it cool to room temperature. The next steps must be done using only your yellow "bug" safelight for illumination. Lean the dry, clean board up against a newspaper backdrop and spray it well with the photoresist. Get on a good, thick coating and be sure to cover the complete copper surface. Daub off any excess on the bottom edge of the board, and place it into the oven, leaning vertically against the back wall. It is important to dry the photoresist quickly, as airborne dust particles will stick to the surface until it dries. Dryout will take about 15-20 minutes at 100 to 115° F. Do not overheat the photoresist as this will destroy its properties.

Exposing and Developing the Board

While the photoresist is drying in the oven, get your contact frame ready again. The G.C. photoresist instruction calls for exposure using ultraviolet or sunlight, but I get good results using the same 150W photoflood lamp as is used for exposing the film. Since the resist is not as sensitive to this light as to ultraviolet, it takes longer to properly expose.

Place the coated board in the contact frame, and center the negative over the top. Cover the top with the glass. Expose the board for about 8 minutes at a distance of about 30.5cm (1'). After exposure, plunge the board in the G.C. developing solution for about a minute, using slight agitation. The image should form quickly as the unexposed resist washes off in the solution. Pull the board out and let the solution evaporate for

a few minutes. The normal room lighting can come on now, as the board is no longer light-sensitive. Rinse the board off with warm water and dry it with a soft cloth, using a blotting motion. Look the board over very carefully to make sure the pattern is complete, and has no pin holes or breaks. Defects are generally caused by a lack of cleanliness. Touch-up can be done with a resist pen, if necessary.

Etch the Board

My favorite etchant is ferric chloride, which can be "rejuvenated" and used over and over. I use a large plastic dish about 20.4cm (8") square and 10.2cm (4") deep about 2/3 full of the ferric chloride. Heat speeds up the etching rate, so a glass aquarium heater is immersed in the solution to heat it to about 100°F. CAUTION: Never use any aluminum around ferric chloride as it reacts very violently. In fact, it is best to keep any metal away from your etching tray. To further speed up the etching process, you may use air from a small aquarium pump to "bubble etch" the board. Immerse a large aquarium aeration stone in the solution and float the board on the surface, face down. The pump air bubbling up from the stone through the ferric chloride etches the board very rapidly. A fresh batch of ferric chloride, using bubble etching, will completely etch a board in about 5 minutes. After repeated use, the etchant becomes saturated with all the copper it has dissolved until it finally refuses to etch away any more copper. Some of this copper can be removed from the solution by the addition of muriatic acid (hydrochloric).

Carefully add about 2 fluid ounces of the acid per quart of ferric chloride, and let air bubble up through the solution for 12 to 24 hours. This will rejuvenate the etchant enough to make it very active again. When it again becomes saturated, simply repeat the rejuvenation. The solution gets darker and darker each time, but I have observed no adverse effects. I can't say how many times this rejuvenation can be successfully carried out, since I have been using my present gallon for almost two years. I have added about a quart of muriatic acid over this period, and it is still going strong. I owe this idea, and the bubble-etching technique, to Larry Hutchinson, who had an excellent article on the subject in the September, 1971, issue of Ham Radio.

After etching the board, rinse it thoroughly with running water. Strip the resist from the unetched areas of the board with acetone which is much cheaper than most commercial stripping solutions. Saturate a small piece of cloth with the acetone and scrub off the resist, then rinse again with water and dry.

Final Touches

If desired, the board can now be trimmed to size, drilled and the components soldered in. However, a much better looking board can be made by plating the copper with a tin lead compound. This not only makes the board much easier to solder, but also insures the copper surface will not corrode. I use an electroless plating solution made by The Dynachem Corporation, Number EBS-250. To use, heat some of the solution in a pyrex dish to about 140° F on a hotplate. Dunk the board in, and in about 20 minutes the plating is complete. The coating is not very thick, only about a tenth of a mil, but is plenty for our purposes. The Shipley Company in Newton MA also makes a product called LT-27 immersion tin, but I have not tried it. After plating is completed, rinse the board in hot water and dry. You now have a high-quality printed circuit board which can be duplicated easily and exactly by reusing your negative. Be sure to store your negatives and artwork where they will not become dirty, scratched or otherwise damaged. I put mine in manila envelopes and store them in my card file.

Conclusion

The techniques described above represent the optimum answer in my case to the tradeoffs between cost, complexity and quality. My boards now rival commercial boards in appearance and repeatability.

However, some features of commercial boards are either too expensive or complex at this time to duplicate in the average home workshop. For instance, plated-through holes, multi-layer construction, wave soldering and spray etching. In addition, making double-sided boards, although I have done it, is still too difficult and time-consuming to justify in most cases. I am still looking for cheap and simple solutions to the above problems. In the meantime, try it my way — you'll like the results. ■

PHOTOGRAPHIC MATERIALS
AVAILABLE AT PHOTO SUPPLY SHOP

Film

1. Naccolith Type "P" 25-10.1 cm x 12.7 cm (4" x 5") sheets for approximately $2.50.
2. DuPont Cronar Engineering Reproduction Film 50 — 10.1 cm x 12.7 cm (4" x 5") sheets for approximately $5.00. Also available in larger sheets which can be cut to any desired size.

Film Safelight

Any type — with a 1 A filter — use a 25 — 40 W bulb.

Film Developing

1. DuPont 21D or 24D Litho Developer
2. Kodak Developer

Film Fixing

1. DuPont 18-F Universal Fixer
2. Kodak Universal Fixer

Adding An Ammeter to Your Car

by
W. J. Prudhomme WB5DEP
1405 Richland Avenue
Metairie LA 70001

In an effort to simplify the operation of automobiles, most car manufacturers have, for many years, incorporated an "Alternator Indicator Light" on the instrument panel in lieu of the ammeter of days gone by. While this "Indicator Light" requires less attention while you are driving, it does not give you complete information on the state of your electrical system.

A recent experience with my car brought this fact to light and convinced me that my car should have an ammeter. Over a period of weeks, I was unaware that the output of my alternator was steadily deteriorating and not charging the battery properly. Eventually the battery completely discharged and left me stranded away from home. The outcome from the experience was that I had

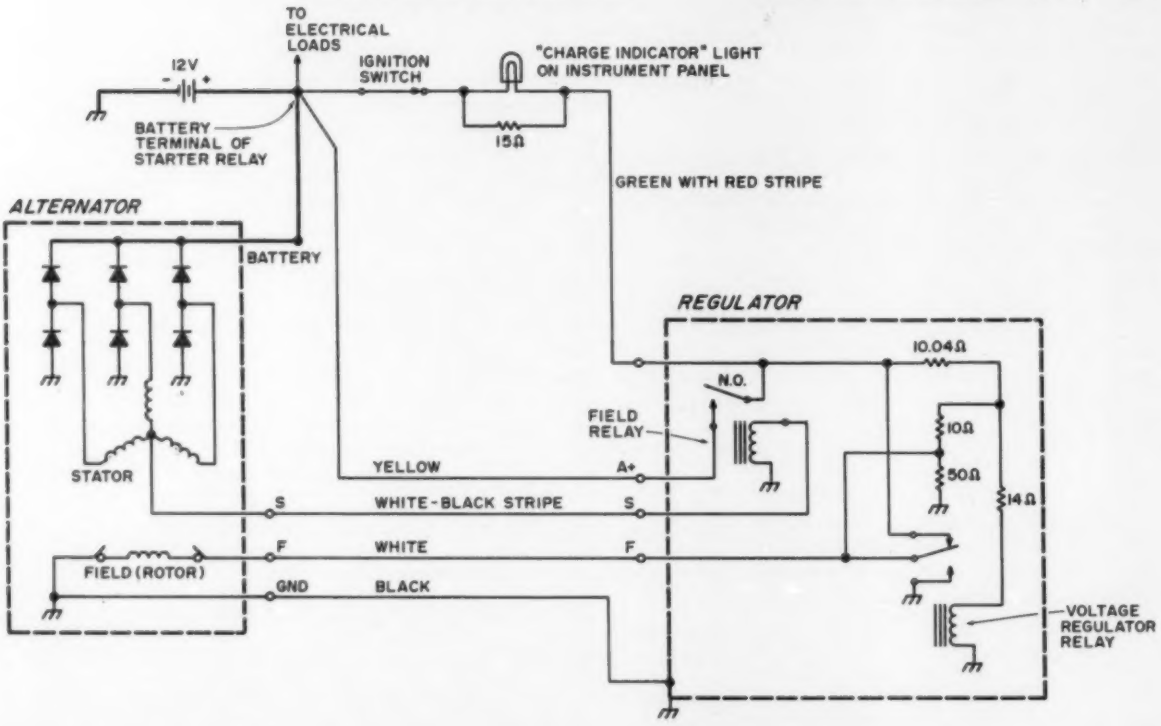

Fig. 1. Ford electrical system with electromechanical type regulator. (Other electrical systems are similar.)

to install a new alternator and I came very close to completely ruining a relatively new battery. During the entire time that the alternator was failing, the indicator light on the instrument panel would turn off during normal driving indicating that the alternator was "charging" and apparently, according to its indication, there was no problem. It occurred to me from this experience, that it would be better to have some type of indicating ammeter which would indicate the state of the system as to whether the battery was being charged or discharged. This article describes a method of installing an ammeter into your existing automobile system without any changes or modification to the existing system and at a very low cost. In fact, it is so easy and inexpensive to incorporate it into your system that you shouldn't be without one, especially if you operate mobile radio equipment which adds an additional drain to your car battery.

Advantages

The system I am about to describe has several advantages which make it attractive for an amateur to install in his car. These advantages are:

(1) All leads are at ground potential, so there are no problems with shorts in the system or the necessity of fusing the conductors.

(2) No heavy currents pass through the indicator, so small conductors may be used.

(3) Although the system makes use of shunt resistance to measure the current, a unique method is used so that no additional voltage drops are added into the present electrical system.

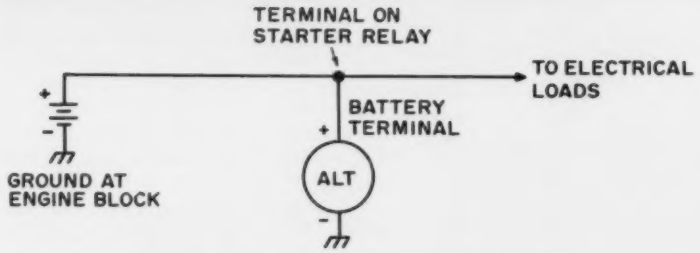

Fig. 2. Simplified diagram excluding the regulator.

(4) It is very easy to add to your existing electrical system – no changes in existing wiring.

(5) The ammeter circuit can easily be adapted with a switch and resistor to read system voltage.

(6) It is inexpensive to install and depending on the type of meter movement you install, the cost can range anywhere from $1.50 to $7.00.

With these advantages, I feel certain that more amateurs will want to install an ammeter to their car electrical system to monitor the battery charging rate.

Typical Electrical System

Referring to Fig. 1, a diagram for Ford Electrical System is presented. This system incorporates an electromechanical voltage regulator and is the type used in my own car (although other systems such as General Motors are similar). As you can see, the alternator consists of a stationary 3Ø stator winding in which the output goes to a set of diode rectifiers. These diodes are arranged in such a manner that the output at the battery

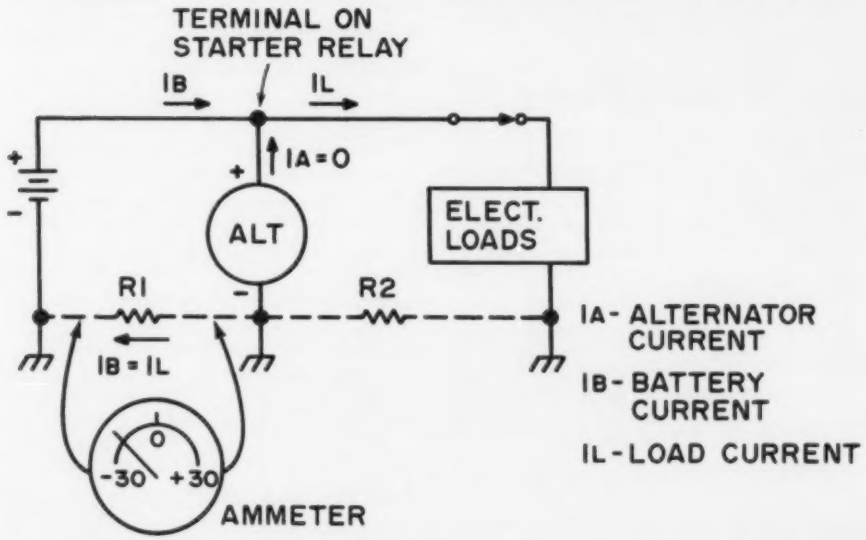

Fig. 3. Basic electrical system showing resistance in ground path circuit – discharge condition (engine stopped and electrical loads connected).

terminal of the alternator is always positive. There is a rotating field which excites the stator winding during normal operation. As you can see, the alternator is always connected directly to the battery through a terminal block, and it is at this point that the other electrical loads in the car are connected. The neutral from the stator winding is grounded through the field relay winding in the voltage regulator and its contacts are normally open. When the ignition switch is turned on, a certain amount of voltage from the battery is connected directly to the field through the charge indicator light on the instrument panel. After the engine is started, and the alternator is producing current, the stator current flowing through the field relay winding pulls the contacts down which in turn bypasses the indicator light on the instrument panel. In other words, as long as the alternator is producing current of sufficient magnitude to hold the field relay contacts closed, the charge indicator light will be off, indicating that the alternator is producing current.

This system works fine as long as all elements in the system are operating under normal circumstances. However, as long as the alternator is capable of producing enough current to operate the field relay contacts, the charge indicator will be extinguished although there may not be enough current produced to charge the battery. Under these circumstances, the charge indicator light does not give a true picture of what is happening in the system, and it also does not indicate the amount of discharge or charge condition of the battery.

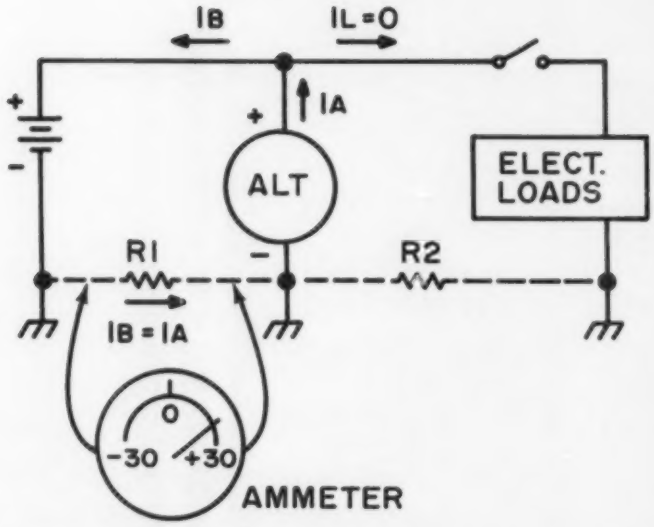

Fig. 4. Charging condition — engine running with electrical loads off.

Referring to Fig. 2, I have indicated a simplified diagram of the battery-alternator connections without the regulator or field windings shown. As you can see, the alternator is continuously connected to the battery and to the other electrical loads usually at the terminal of the starter relay. During normal operation of a car, the alternator performs two functions. First, it produces enough current to operate the electrical loads in the car and second, it produces current to flow back into the battery to charge the battery during normal driving conditions. There may be a time when a faulty alternator does not produce enough current to do both, and it is under these circumstances that you may end up with a dead battery and no forewarning of that condition.

Also, from the diagram, it appears logical that the correct location for a charge indicator would be somewhere in the battery circuit, either between the positive terminal on the alternator and the positive terminal on the battery, or between the negative terminal on the battery and ground. This indicator should have a zero center scale so that it would indicate a discharge condition (battery drain) or indicate a charging condition from the alternator. The usual method of connection is to add some type of shunt into the system in order to sample the amount of current flowing in the conductors to provide an indication. However, if a shunt is added into the circuit (such as the ¼ Ohm shunts which are used on most automotive ammeters you can purchase at a store) you incorporate an additional voltage drop into the system. By accident, I determined a unique feature of automobile systems which you can make use of in what I call a built-in shunt condition.

Ground Paths

Referring to Fig. 3, I have indicated a simplified electrical diagram showing electrical loads connected to the system. This is a discharge condition in that the engine is stopped and there is no output from the alternator. Since the alternator remains connected to the system, it would appear that some drain would also result from the alternator. However, keep in mind that the alternator windings are connected to the positive terminal through diodes, and therefore, no reverse current can flow through the alternator. Under this condition, the alternator current $I_A = 0$. Applying Kirchhoff's Law which states the sum of the currents entering a junction is equal to the sum of the currents leaving the junction, we have the battery current I_B entering the terminal and the load current I_L leaving that junction.

Since the alternator current is equal to zero, $I_B = I_L$, or simply stated, the battery is supplying all of the required power to operate the load.

Let's discuss for a minute the theoretical versus actual conditions. We normally think of the negative terminals of the battery, alternator and loads all being grounded together so that all negative terminals are at the same potential. However, in most cases, we are depending on the frame of the car as a ground return path, and since steel is a mediocre conductor, there is always some inherent resistance incorporated into all automobile electrical systems. I have represented this resistance as being R1 between the battery negative terminal and the alternator negative terminal and R2 between the alternator and the electrical loads. Applying Ohm's Law, the voltage drop across R1 would be:

$$E = (I_B)\,(R1)$$

Granted, the resistance of R1 is small, in the neighborhood of 0.01 to 0.1 Ohms, but the currents are very large — in the neighborhood of 10 to 30 Amps (except during starts when it is much higher). Consequently, the voltage drop across R1 is a measurable quantity and can be used to indicate which way the current is flowing in the battery-alternator loop. This is shown on the meter in Fig. 3 as a discharge situation.

Fig. 4 is a diagram of a basic charge condition in which the engine is running and no loads are connected. Again, applying Kirchhoff's Law with $I_L = 0$ we have: I_B is equal to I_A, and the voltage drop across R1 is $E = (I_B)\,(R1)$, but is of the opposite polarity of the discharge condition in Fig. 3. As the battery becomes charged, the alternator current charging the battery gradually tapers off and so will the voltage drop across R1 so we get a direct indication of the condition of the battery, and we know exactly when it has reached full charge condition.

In Fig. 5 we have a diagram showing normal operation of the vehicle in which the engine is running and certain electrical loads are connected. Under this situation, again applying Kirchhoff's Law, we have I_B and I_L leaving the terminal and the alternator current, I_A, entering the terminal. Stated as an equation, $I_A = I_B + I_L$. This means that the alternator has to supply enough current to operate the electrical loads and charge the battery at the same time. Of course, as the battery becomes fully charged again, the battery current will gradually taper off, and the alternator will be operating mainly to supply current to the electrical loads connected to the system.

Ohm's Law Applied

It is apparent that there will be some voltage drop which can be measured across this ground path resistance, but just exactly how much will be measured and how can it be utilized in a charge indicator?

Let's take for example, that the ground path has a resistance of only 0.01 Ohms and that a typical alternator is capable of producing at least 30 Amps. The voltage drop across the ground path of resistance would then be:

$$E = IR = (30)\,(.01)$$
Therefore, E = 0.3 volts

This voltage is easily measured and the instrument may be calibrated in terms of Amps, that is, 0.1 volts would indicate a current of 10 Amps.

If the normal charging rate is, for example, 10 Amps, the voltage measured would be 0.1 volts. From this example, it is clearly evident that there is plenty of voltage available for a sensitive indicator and can be used to our advantage in a charge indicating instrument without adding additional shunt resistance into the electrical system. Our next problem is to determine how and where to connect the meter in the circuit.

Basic Ammeter Circuit

Fig. 6 shows the actual circuit used in my car with a 50 uA meter. This instrument, as with most instruments (even the very inexpensive tuning indicator instruments) can be converted to a zero center scale instrument so that my meter now has become a ±25 uA meter. I also installed a meter protector circuit across the terminals to limit the current during starting, and added a 2k

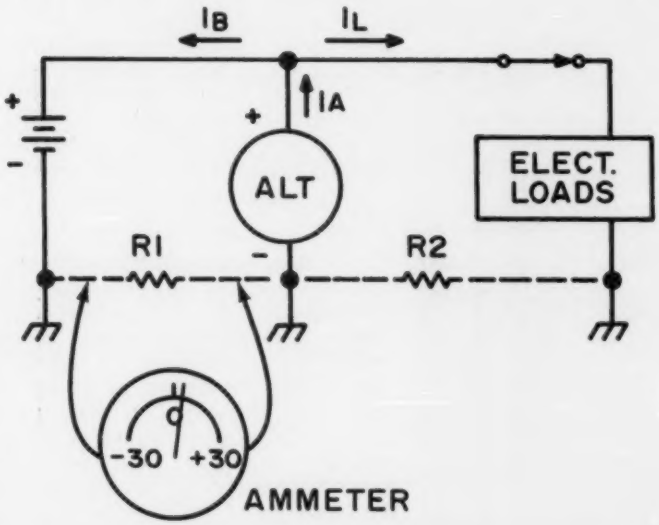

Fig. 5. Typical operating condition with battery charging current tapering off.

resistor into the circuit to allow for calibration of the meter.

As I mentioned, the basic movement that I used was a 0-50 uA meter manufactured by Midland, Model No. 23-206. However, any meter may be used, possibly up to a 0-1 mA meter, depending on your own particular situation. You may want to use a VOM to check your particular ground path circuit under normal conditions to find out how sensitive a meter movement will be required in your particular case. After this has been determined and you have a meter available,

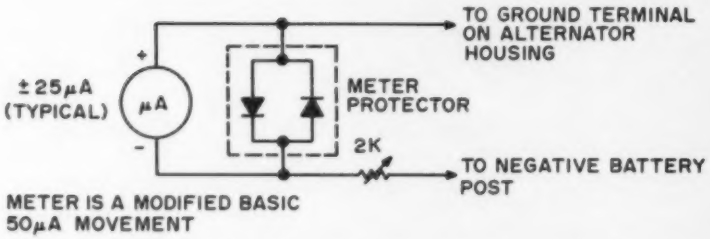

Fig. 6. Actual diagram for adding an ammeter to car electrical system — no changes are required to existing wiring.

the next step is to carefully remove the plastic cover on the meter. Then, after removing the two retaining screws of the dial, it must be carefully slipped out from under the pointer. Then, all that is necessary is to erase the lettering not required and to add in new lettering according to your own particular circumstances.

The next step is to convert the instrument to a zero center scale type instrument. This is easily accomplished by moving the zero adjustment until the pointer is at mid-scale. It is possible to do this on all instruments that I have seen, including the little horizontal movements that are available through surplus outlets for a dollar and a half. The quality of the instrument is governed only by your own particular needs. The final step is to replace the dial and plastic cover and install the protective diodes across the meter terminals along with the multiplier resistor used for calibration.

Installation Details

The next step involves installation in the car and connecting the meter leads to the proper points in the electrical system. It is best to use solid conductor wire of approximately 18 gauge, and if you can find Teflon-coated conductors, so much the better. Since the leads will be near hot parts of the engine, Teflon-insulated conductors are more resistant to heat and grease in this type environment. The two leads from the instrument circuit should be routed through any available opening in the fire wall and around to the alternator and negative terminal of the battery. One conductor is connected to the ground terminal on the alternator housing. The other conductor is connected to the negative battery terminal right at the battery post. To check to see if you have the right polarity, leave the engine off and turn on some load such as headlights or press on the brake pedal. The instrument should swing from the zero center scale to the left indicating a discharge condition. If it swings the other way, the leads should be reversed. The next step is to get a rough calibration on the instrument. Turn on headlights or some other load with a known Amp rating and roughly calibrate the instrument based on this amount of load. If you have another ammeter, you can use it to check and calibrate your new instrument.

It is imperative to connect the ammeter circuit into ground path R1 between the battery negative terminal and the alternator ground terminal. Otherwise, if by mistake it is connected between the battery negative terminal and ground near some of the electrical loads, it is easy to see from the basic diagrams above that you would get roughly twice the indication on discharge which is the sum of the voltage drops across R1 and R2 in a discharge condition. In a charge condition, the indication will be the difference between the voltage drops across R1 and R2 since the voltage drops are in opposite directions. This obviously will give you false indications and will be useless as far as determining the state of charge of your battery.

Conclusion and Results

You are probably wondering at this point as to whether or not it would have been easier to buy one of the commercially available ammeters for six to ten dollars and not have the problem of converting another meter for use in this project. It is true it may have been easier, but the meter movement in commercial automotive instruments is not known for its quality and there are usually no means of calibrating the commercial instrument. Also, most commercially available instruments make use of an additional meter shunt into an electrical system of approximately ¼ Ohm. Admittedly, this is not very much resistance to add into a circuit, but a quarter Ohm at 20 Amps could introduce an additional voltage drop into the automobile electrical system.

My particular charge indicator has been in operation for some time, and it has been a great help to me in monitoring my automobile electrical system. Since many amateurs have mobile equipment added into their cars, I hope this article will be of benefit to them in keeping their equipment in top operating condition. ■

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Really Soup Up Your 2m Receiver

by
Calvin Sondgeroth W9ZTK
800 Fifth Avenue
Mendota IL 61342

Using semiconductors now available for VHF service it is possible to build a preamplifier for 144 MHz that will perform as well or better than all but the best vacuum tube designs in terms of gain and noise figure. The solid state approach offers several advantages over a vacuum tube amplifier in size and power requirements. The preamp described is completely self contained and can be powered for many hours by a small transistor radio battery. In addition, semiconductor prices are now about one fourth the cost of a new vacuum tube for the same job. The money saved by using the transistor can be well spent on a couple of good quality components for the rest of the circuit.

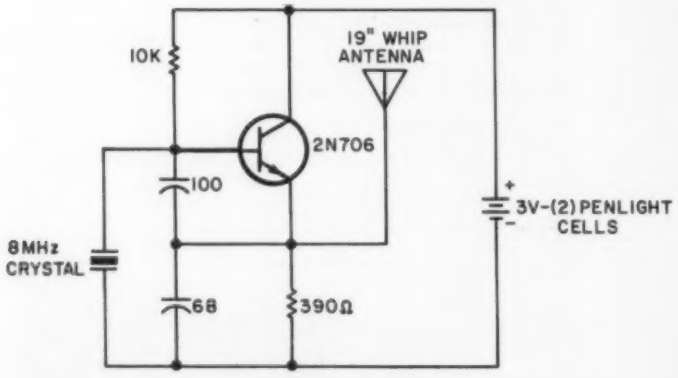

Fig. 1. 144 MHz weak signal source.

Circuit Description

The circuit for the preamp is shown in the schematic diagram. Q1 is operated in a grounded base configuration for best stability at 144 MHz. The input impedance of this type of amplifier is quite low and the emitter is tapped down well toward the ground end of the input coil L1 compared to the tap position that might be used in a tube amplifier. The emitter is raised above ground by R2. A choke in the emitter lead with R2 bypassed for rf was tried, but the amplifier seemed to work as well with R2 alone, so the choke was abandoned. The input and output coils L1 and L2 are identical except for the second tap on L1. They are wound with #18 bus wire with 4½ turns spaced out to ½" long. Both input and output tanks are tuned to resonance with piston type trimmer capacitors. Here is where the money saved on buying a new 417A tube or its equivalent can be put to good use. The price difference between the tube and transistor will just about pay for two good quality capacitors. The piston tuning action makes circuit adjustment very smooth.

The bias operating point for the amplifier is set by the voltage divider R1 and R3; the value of R1 is adjusted for optimum gain versus noise figure as described later.

Construction

A pictorial drawing of the mechanical layout of the amplifier is shown. A standard

1-5/8" X 2-1/8" X 3-1/4" minibox serves as a shielded enclosure for the finished unit. Q1 and its associated components are mounted on a piece of 1/16" thick copper clad circuit board material that just fits inside the box with clearance at the sides for the cover. The transistor is mounted through a 3/16" hole in the center of the board with a second piece of circuit board material soldered vertically across it to act as a shield between the input and output circuits. The shield has to be notched to clear the transistor leads with the emitter and base leads on the input side and the collector and the fourth lead connected to the transistor case on the output side. The case lead is soldered directly to the ground copper on the center shield.

Two 500 pF feedthrough capacitors serve as the points for the base and the B+ leads; two insulated terminals are used for the emitter and collector connections. The bias resistors R1 and R3 are mounted on top of the board as shown for ease in adjusting their values. The emitter resistor R2 could probably be on top as well, but I thought it best to keep it down inside the shielded input compartment since it is above rf ground. The piston trimmers are located approximately as shown with the coils connected to them as indicated on the schematic. This general layout makes for the short leads important in VHF wiring. Ground connections are soldered directly to the copper on the circuit board.

After the circuit is wired up on the board it is mounted inside the minibox as shown with two standoffs and screws in diagonal corners. Two dummy screws in the other corners act as feet to match the screws going through the standoffs. The four resulting studs can be used for mounting to another chassis if desired. The input and output connectors J1 and J2 are mounted on the ends of the box. The output end has a 500 pF feedthrough capacitor and a ground terminal for connection to an external battery.

Adjustment and Tune-up

For preliminary adjustment of the preamplifier, connect a 5000 to 10,000Ω potentiometer in the circuit in place of R1. Tuning is done on a weak signal. If your location is like mine there will either be no signals at all or those present will be weak, so for extended periods of adjustment a local signal source is desirable. A grid dip meter can be used, but the stability of a crystal oscillator like the one shown is much better. Its harmonic in the 2 meter band is fairly strong and the signal source can be removed from the receiver location until the signal is just readable without the preamp ahead of the receiver so that improvements with the preamp connected can be noted.

With the amplifier in the line and the bias adjust pot approximately in the center of its range, the weak signal is tuned in and C1 and C2 are adjusted for maximum signal. With the tanks peaked, adjust the bias pot for best improvement in signal over the noise output of the receiver. Remember that what we are looking for is best margin of signal over the noise and not maximum S-meter or other output meter indication. In general a bias point where the noise output of the receiver just starts to increase is optimum. Increasing the voltage at the base of Q1 too much beyond this point increases the noise output of the amplifier, and a point is reached at which the increase in gain obtained is not enough to make up for the poorer noise figure of the system.

When the pot has been set for optimum performance its value is measured and replaced by a suitable fixed resistor. Values from 2000–4000Ω can be expected with the 2N2708 specified. Two holes are added to the minibox cover for access to C1 and C2 since putting on the cover detunes the input and output circuits slightly and they must be retuned with the cover in place.

For simplicity, and improvement in two meter work, this kind of device is hard to beat . . .

Conclusions

The transistor specified was used because it was available. It is rated up to 200 MHz with a gain of 15 dB and costs a little under $3.00. Other RCA transistors in the same family should work just as well. For example, the 2N4936 is rated at 20 dB gain up to 450 MHz and is even less expensive than the 2N2708.

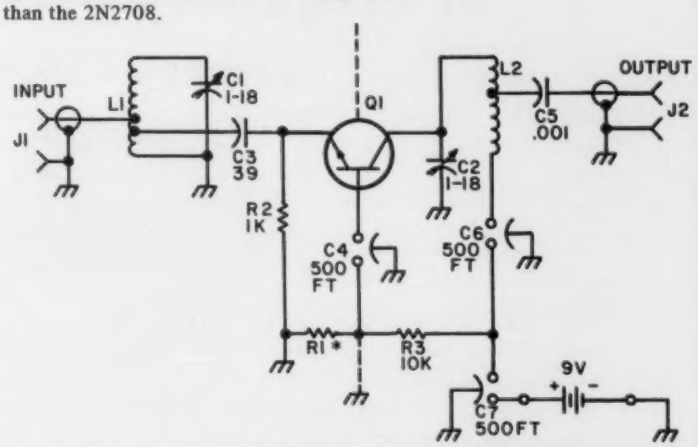

*Fig. 2. L1 – 4½ turns #18 3/8" diam x ½" long; tap at 1 turn for emitter; tap at 1½ turns for input. L2 – 4½ turns #18 3/8" diam x ½" long; tap at 1½ turns from B+ end. Q1 – Ep. F1. NPN silicon transistor, 2N2708. C1, C2 – piston trimmers. J1, J2 – BNC coax connectors. *Adjust R1 for optimum gain vs. noise figure.*

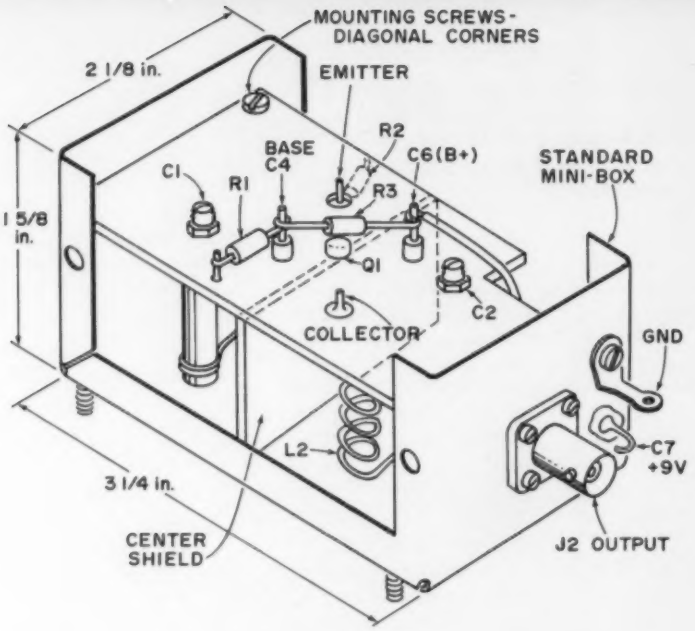

Fig. 3.

The preamp should help out considerably when used ahead of a poor receiving setup on two meters. It will not do much ahead of a good low noise converter since the noise figure of the preamp will degrade the overall performance of the system. When tried on a W2AZL 417A converter all it did was make the S-meter readings higher; reception on weak signals was about the same with or without the preamp. However, ahead of the "twoer" or other marginal two meter receiver, the preamp adds the gain needed for copying weak signals.

No trouble with instability was encountered, although with very high stage gain the circuit can start to oscillate. With a bias setting this high, the noise output of the amplifier makes it practically useless; at normal operating bias as adjusted above the circuit is quite tame. The isolation between input and output is very good since the circuits are effectively in separate enclosures formed by the minibox, the circuit board and center shield.

For simplicity and improvement in two meter work, this kind of device is hard to beat. With a few parts and a spare evening, it can be put together and tried ahead of the receiver with a minimum of metal work and chassis drilling. And the best part comes when the battery can be used instead of digging into the receiver or another power supply. ■

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How's Your Speech Quality?

73 Magazine Staff

The objective of speech processing has always been to obtain more "talk power" from a given transmitter. In the case of SSB, this has meant increasing the average to peak ratio of the af (and hence eventual rf) waveform.

In FM systems, it has meant limiting the maximum allowable deviation to not exceed the receiver passband. Compressors, clippers or combinations of the two methods are used to accomplish the desired effect.

One problem that often arises with simpler circuits is that an increased bassiness appears in the processed speech the more it is processed. The reason for this may not be apparent when one looks at the so-called frequency response of a compressor or clipper circuit as shown in Fig. 1.

The problem arises because the frequency response of the compressor or clipper circuit will change depending upon the input level. The response of Fig. 1 is plotted before any compressor or clipping action becomes effective and looks classically effective.

The low frequencies which contain most of the speech power but little of speech intelligibility are reduced in value and a gradual rising response to about 3 kHz gives emphasis to the higher frequencies which provide a "presence" effect in the speech.

If one plots the frequency response for different values of compressor or clipper action, as shown in Fig. 2, it will be seen that as the amount of compression or clipping increases, both the low and high frequency response of the output is extended.

The compressor/clipper action in most such circuits, which are not frequency selective, simply levels out the whole output over the entire speech frequency range. The harder one "hits" the compressor/clipper, the more pronounced is the effect. So, one can often not achieve the maximum value from such a circuit and ends up with a compromise setting of the circuit. This provides some increase in talk power without too much speech degradation.

Another problem also enters the picture – the problem of distortion due to the generation of intermodulation and harmonic

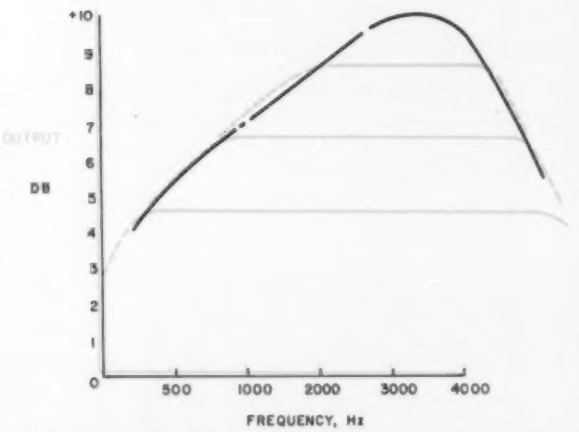

Fig. 1. (Black) Typical tailored voice frequency response of a speech processing unit at very low input levels.

Fig. 2. (Grey) The output level of a speech processor as the circuit is adjusted to clamp the output at different levels. Notice that as the output level is more severely clamped the overall frequency response becomes broad and flat.

products in the compressor/clipper circuitry the harder it is driven.

The latter problem will occur first in some compressor circuits and would tend to indicate that the input stages are not designed with a great enough dynamic range.

Sophisticated, and costly, compressor/clipper units get around some of these problems by splitting the frequency band to be processed into different ranges, applying a weighted processing to each range and other techniques. Broadcast quality, after all, just doesn't mean an ultra smooth frequency response but keeping that transmitter modulated within FCC specs just as heavily as possible.

Compare a recording of a good AM or FM talk station with that obtainable from any amateur speech processing unit. If the recording is made such that the peak input level to the recorder is the same in both cases, the tremendous difference in effectiveness of the commercial unit is apparent.

The point here is not to criticize amateur circuits since commercial units cost thousands of dollars and are part of an engineered microphone-to-modulator chain, but to indicate that much still remains to be done in the amateur sphere.

One improvement that can be made in most simple compressor/clipper circuits is to correct the frequency response to get away from the problem previously described.

Two methods are possible – either a dynamic circuit that will correct the input frequency response according to the amount of compression or clipping, or a static filtering circuit both before and after the compressor/clipper circuitry.

The author has experimented with active circuits using FETs as variable resistance elements in a 2 stage RC high-pass filter arrangement placed before the input to a compressor. The control voltage developed in the compressor was also used to control the FETs and in such a manner that the greater the control voltage developed (due to greater input levels), the frequency slope of the high-pass filter was changed to attenuate the lower frequencies more and more.

The circuit did work but every component had to be tailored to work with a particular compressor circuit. Therefore, since it is far from a universal approach the circuit details are not presented here.

A more universal approach involves the use of passive components to form a suitable filter both before and after a clipper or compressor circuit. The details of such filters are shown in Fig. 3 for typical low impedance input and output circuits. Standard handbook formulas can be used to design the filters for any desired combination of impedance levels.

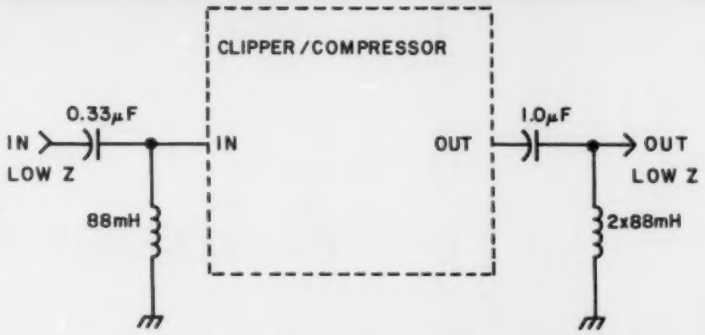

Fig. 3. Some typical circuit values for the filters discussed in the text.

The input filter performs a pre-emphasis function to reduce the low frequency to drastically reduce the low frequency components. It has a cutoff frequency of 800-1000 cycles.

The main purpose of this filter in reducing the low frequency input to a compressor or clipper is to reduce the inter-modulation products caused by the low frequencies, and which remain within the speech passband up to about 4 kHz. This will allow a greater degree of compression or clipping to be used. The output filter is a high-pass filter with a cut-off of about .3 kHz in order to provide the low frequency rolloff which is lost when heavy compression or clipping is used. In the case of a clipper, it is assumed that it already contains the necessary low pass filter to reduce the harmonic energy above about 4 kHz.

The filters have only a few dB insertion loss in their passband and so can be used with almost any compressor or clipper circuit which has just a bit of reserve gain. There are no particular construction problems with the filters. Standard surplus toroid telephone coils are highly recommended for the inductor elements and are inexpensive to use.

One might like to experiment with the rolloff frequencies of the filters by varying the capacitor values slightly to suit individual voice characteristics. The use of the filters will definitely enhance the effectiveness of most compressor or clipper circuits. It's accomplished both by allowing a greater degree of compression or clipping and by eliminating the low frequencies at the output of the processed speech which do not contribute to communications effectiveness. The enhancement of a transmitter's effectiveness by such speech filters in conjunction with a compressor or clipper is a matter of subjective evaluation.

Most tests indicate a 2-3 dB improvement. The component costs make this method quite a bargain – and beat raising the transmitter power. ■

A Transmission Line² Matcher

by
Carl C. Drumeller W5JJ
5824 N.W. 58 Street
Warr Acres OK 73122

That title may require some explanation. What it really means is that a length of coaxial rf transmission line is used to effect compatibility between the output impedance of a transmitter and the presented impedance of a transmission line leading to its antenna. Often, you effect such a match by means of an antenna tuning unit. The British call these ATUs. We use a variety of fancy terms, like "Z-matchers," "Transmatchers," "Matchboxes," etc. They all do the same job.

If the mismatch is not extreme, no more than you'd encounter with a VSWR of around 5:1, a section of transmission line can accomplish an acceptable match.

We've all been told many times of the application of a ¼λ section of line for impedance matching. Less often, however, have we heard about the use of other lengths for transforming impedance. That's the purpose of this article.

First, we need to take a look at a graphical representation of the voltage standing wave upon a mismatched transmission. This is often shown in handbooks. A few even hint at the reactances present. These reactances, which vary in both magnitude and sign (inductive or capacitive) as measured along a ½λ section of line, can be put to use. We're going to talk about using them as conjugate reactances, that is, of equal magnitude but opposite sign, to negate undesired reactances on an antenna feedline. Fig. 1 shows the extreme case of a line terminated in a short circuit. Fig. 2 depicts another extreme, a line terminated in an open circuit. Note that these two differ only by 90°. That is, if you were to slide one 90° to a side, it would be the same as the other. From this, you can deduct that *all* other terminations lie somewhere between these two extremes. So they do, regardless of whether they're purely resistive, purely reactive, mixtures of the two (as are most real-life antennas), higher than the characteristic impedance of the line, or lower.

Now, with this as a starter, let's take a look at the average transmitter. In all probability, it was engineered (probably much against the design engineer's better judgment but by the stern orders of the sales department) "to be used with transmission lines with a VSWR of not more than 2:1." This is choice weasel wording to give the manufacturer impunity should an inept user damage it by some gross misuse.

Let's consider why the manufacturer likes to include the weasel wording. Look at Fig. 1. Points A, C and E have an impedance that is purely resistive and very, very low. You couldn't make such a termination accept power. Points B and D also are purely resistive, but their impedance is very high. It's improbable that these could be made to accept power. In Fig. 2 the same comments apply, only with the high and low impedance points flipped over. But Fig. 3 shows a line terminated in a resistor, one higher than the line's characteristic impedance so that there're standing waves present. Not only are points A, B, C, D and E resistive, but there's a resistive component present at any point along the line. This means that you can slice off that line at any point you desire and still feed rf power to your antenna. But, there's a hooker. There always is. This one concerns all points between the lettered points. Anywhere in these regions the line will present a combination of resistive and reactive load.

The introduction of reaction gives the manufacturer more cold chills than do the excursions of impedance magnitudes. You see, within the transmitter there must be provision for transforming whatever complex load shows up at the transmitter's input terminals to a purely resistive load of the proper magnitude to produce the desired load for the active device (vacuum tube, transistor, etc.) in the transmitter. In most of today's transmitters this is done through transformations provided by a pi-network. Now, if you've ever looked at the formulas for computing the values of the L and the two Cs in a pi-net you may have noticed that the formulas apply solely to resistive input and output terminations. If that output looks into a complex load, one having a reactive component, all bets are off!

This doesn't mean that a pi-net (or, much better, a Pi-L net) can't cope with a moderately-reactive load. It can, otherwise there'd be very few present-day transmitters capable of being used! It does mean, however, that the transmitter's combination tuning device and impedance-matching device (for that is what the pi-net really is) has to negate the reactive component of the load by introducing a conjugate reactance.

How's that done? By deliberately detuning the plate tank circuit from what would be resonance were the load resistive. This causes the tank itself to be reactive, and, if the reactance is opposite and equal to that of the load, the vacuum tube (or other active device) still sees a resistive load. Sounds like a handy way of getting around a problem, doesn't it? But, like many other solutions, it introduces its own set of problems! When the plate tank is detuned, the carefully-selected LC combination is upset. That ratio was selected upon the basis of Q, of maximum circulating current that could be tolerated, and of the maximum voltage that could be handled. Detune one way, and you may melt down a marginal-design tank coil. Detune the other way, and you may have a voltage flashover across a marginal-design capacitor. And don't think those components are not of marginal design! That's why the manufacturer has to weasel-word his guarantee! He leaves it up to you to provide the necessary protection that he's too cheap to build into his transmitter.

You don't want to re-engineer the transmitter; there's not room enough in the case to accommodate adequate components, anyway. You're not too enthusiastic about plunking down from one hundred to several hundred dollars for a "Matchbox" or a similar device. You'd just as soon avoid the complexity of building a "transmatch." But there's a simple way out!

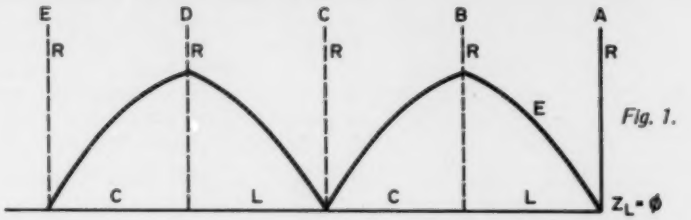

Fig. 1.

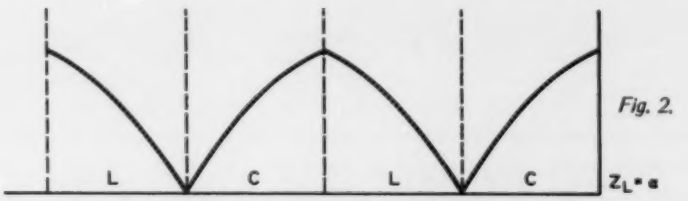

Fig. 2.

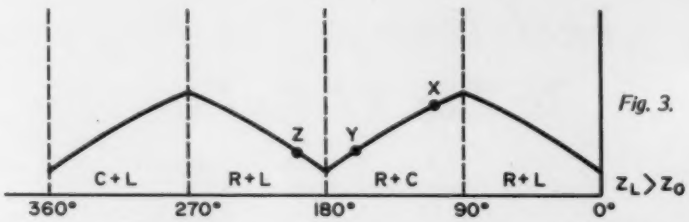

Fig. 3.

Look again at Fig. 3, and keep in mind that the pattern of those convolutions keeps repeating itself every ½λ, regardless of how long the transmission line may be. Now, suppose your line is of such length that your transmitter is trying to look into it at point X. This high impedance very probably is too much for the transmitter to cope with, but if you were to add just enough line length to patch it out to point Y, the impedance will be lowered to a quite reasonable magnitude! Try it. If your transmitter doesn't like a capacitive load, and some don't, just add enough additional line to patch it out to point Z, which is inductive-plus-resistive.

This sounds like a big job, one that requires a slide rule plus a stack of tables and graphs. Don't believe it! Get a few hunks of transmission line of the same impedance as your feedline, a few coax connectors, and experiment. Use low power (turn down the exciter drive), and you'll not endanger your transmitter. You'll be pleasantly astonished at how easy it is to hit (by a purely hit-or-miss technique) upon a presented impedance with which your transmitter is happy. And a happy transmitter is what you're working toward.

Now for a word about what you're *not* doing. You're not "trimming the transmission line to decrease the VSWR." That is a pure myth. The VSWR is determined solely by the relationship of the line's

characteristic impedance and the load at the far (antenna) end. No amount of fiddling at the receiving end or messing with line length will affect the VSWR. Changing line length will, however, change the impedance the line (if it's mismatched) presents to the transmitter. And that's what you'll be doing.

In my case, I'm using a 3800kHz antenna on 4590kHz. Adding about 3.66m (12') to the only-the-Good-Lord-may-know-what length of my transmission line transformed the impedance to a value easily coped with by an ordinary pi-net output circuit. High VSWR? Undoubtedly! High signal loss? I doubt it, for my reports from distant stations compare with those received when using a resonant antenna.

So go ahead and use a "transmission line[2] matching" device. It's simple, it costs very little, and it does the job well. ■

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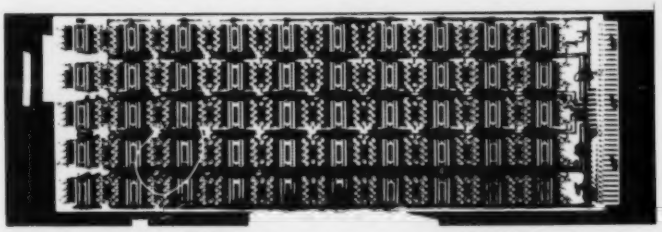

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I/O

ASCII to Baudot Converter

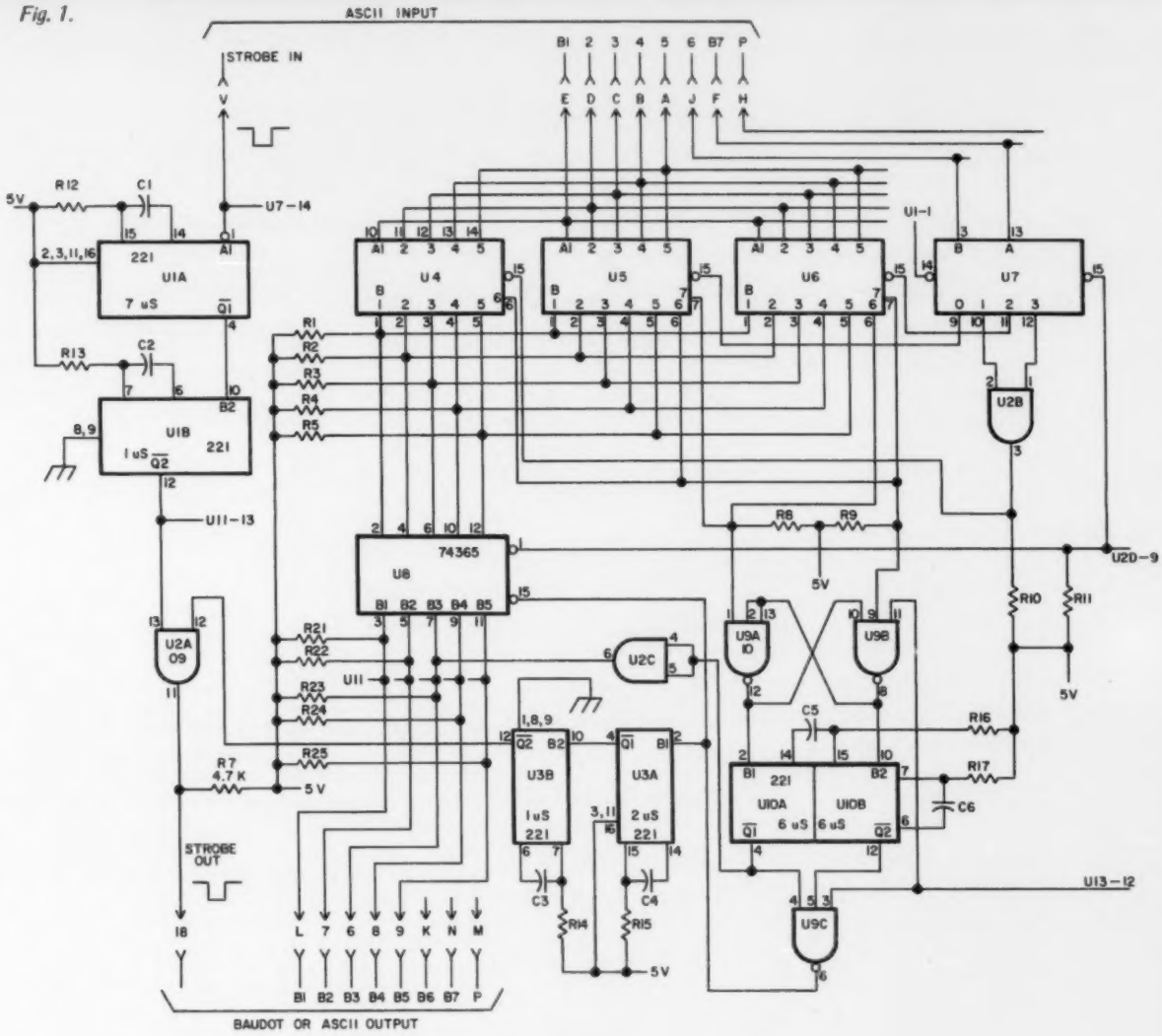
by
Cole Ellsworth W6OXP
10461 Dewey Drive
Garden Grove CA 92640

After acquiring a surplus ASCII encoded keyboard[1] it was desired to use this keyboard on the amateur RTTY frequencies. Under present FCC regulations, only 5-level code is permitted (commonly called Baudot code, but actually a version of the Murray code). Therefore, we needed a conversion device that would change the 8-level ASCII code to 5-level code. There are several different approaches to this problem presently in commercial use. One of the earlier conversion methods utilized tape reperforators and tape readers to accomplish the conversion. The more modern video display communications terminals in some instances use computer memory and software to make the conversion. Some integrated circuit manufacturers have made available commercial versions of custom programmed ROMs which greatly facilitate a bi-directional conversion but seem to be somewhat different in format from my requirements, including low cost.

The ASCII code is capable of generating 128 characters (2^7), of which up to 96 may be printing characters. (The remaining 32 are termed "Control" characters.) The Baudot code is capable of generating only 32 characters (2^5) so a "Case Shift" method is used to provide a second set of 32 characters while maintaining a 5-bit code. Thus the need for FIGS shift and LTRS shift on 5-level machines is apparent. It is the requirement for generation of the case shift character that makes the problem of conversion from ASCII to Baudot so interesting. Conversion in the opposite direction, i.e., from Baudot to ASCII, is relatively simple. Witness the recent publication of a circuit[2] that requires only four ICs to perform the conversion.

I had been mulling around several possible approaches to the conversion problem when two significant situations arose which served to solidify the design approach. The first was during the course of a discussion of the matter with Jerry WB6WPX, when he suggested "jamming" the case shift character into the Baudot output bit stream just ahead of the character requiring the case shift. The second was the development of the UT-4 by Irv W6FFC[3]. The FIFO in the UT-4 makes the perfect buffer for absorption of the case shift character (which is generated within the period of a few microseconds) without

Fig. 1.



significant delay in conversion of the following ASCII character.

An initial cut at the design resulted in a 12-chip circuit with a timing budget that appeared feasible. A second cut at the design resulted in an operational prototype requiring ten chips including the three conversion PROMs. At the suggestions of W6FFC, a circuit was developed to provide automatic generation of a Baudot LETTERS shift character following a LINE FEED. This feature eases generation of proper end-of-line routine when using an ASCII keyboard and is well worth the three additional chips required. The final design uses 15 chips and was dubbed the ASCII to Baudot Converter – version 1 (ABC-1).

The logic diagram of the ABC-1 is illustrated in Fig. 1. Fig. 2 is the converter timing diagram. Interface with the UT-4 is shown in Fig. 3. Note that one additional 7400 chip (IC13) and one switch (S9) must be added to the UT-4 circuitry to provide ABC-1 interface while maintaining full capability of the UT-4 in the originally intended application.

Features

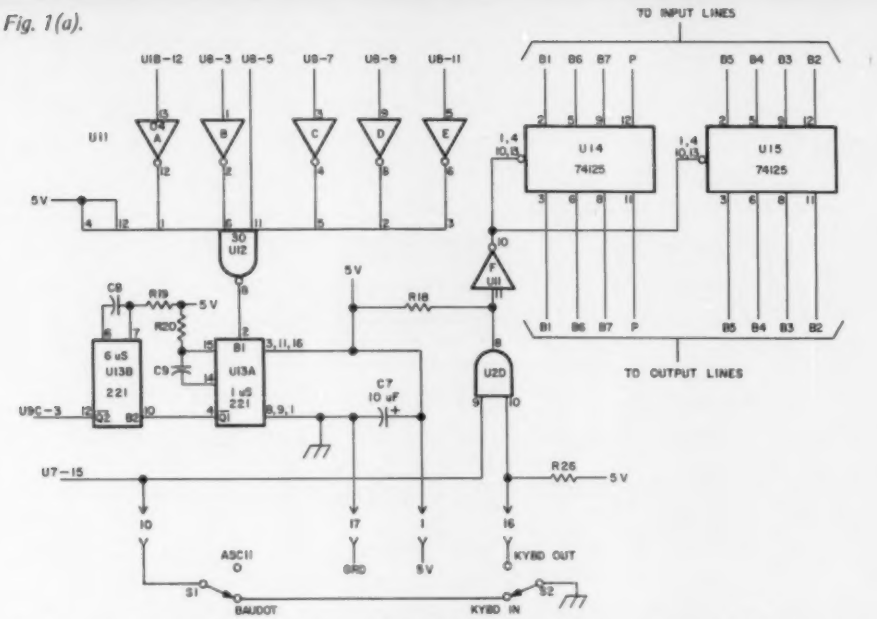
1. Converts all ASCII characters that have Baudot equivalents to the proper Baudot character.

2. Converts all non-equivalent characters to a Baudot BLANK unless otherwise programmed in the appropriate PROM.

3. Converts both upper and lower case ASCII alphabet characters to the equivalent Baudot character.

4. Provides automatic Unshift-on-Space for Baudot machines.

Fig. 1(a).



Figs. 1 and 1(a). U1, 3, 10, 13: 74221. U2: 7409. U4, 5, 6: 8223. U7: 74155. U8: 74365. U9: 7410. U11: 7404. U12: 7430. U14, 15: 74125. R1-5, 7-11, 18, 26: 4.7k. R12: 30k. R13-17, 19, 20: 15k. R21-25: 10k. C1: 330 pF. C2, 3, 9: 100 pF. C4: 210 pF. C5, 6, 8: 560 pF. C7: 10 uF, 10 V. Notes: ASCII inputs B1 through B7 are positive logic (Mark = High level). U4 is alphabet PROM that converts both UC and LC ASCII to Baudot. U5 is control function PROM for Carriage Return, Line Feed, and Bell. U6 PROM converts numerals, punctuation, and space bar. Most ASCII characters with no Baudot equivalent convert to a Baudot BLANK character. U11, 12 and 13 generate a Baudot LTRS shift function immediately following a Baudot LF, thus providing a standard end-of-line routine capability of CR, LF, LTRS. Baudot outputs B1 through B5 are positive logic (Mark = High level). U14 and 15 provide direct ASCII throughput when S1 is in ASCII position. For U1, 3-8, 10 and 13, Vcc is on pin 16 and Gnd is on pin 8. For U2, 9, 12, 14 and 15, Vcc is on pin 14 and Gnd is on pin 7.

5. Provides Automatic Letters Shift after LINE FEED.

6. Provides a Baudot Letters Shift on receipt of ASCII "RUBOUT" or "UNDERSCORE".

7. Provides a Baudot Figures Shift on receipt of ASCII "UP ARROW" or "~".

8. Provides for direct throughput of ASCII code.

9. Provides 3-state buffered data outputs for data bus applications.

10. Easy interface to the UT-4.

Functional Description

Parallel format ASCII data is applied to inputs (address lines) of 8223/74188 PROMs U4, U5 and U6. Note that only bits 1 through 5 are used for addressing the PROMs. Bits 6 and 7 are applied to 2-line to 4-line decoder U7. The binary state of bits 6 and 7 are decoded by U7 to provide an enable signal to pin 15 of the appropriate PROM. Decoding of ASCII bits 6 and 7 is arranged by means of U2B so that both upper and lower case ASCII alphabet will be converted to the equivalent Baudot character.

PROM output data (in Baudot code) bits 1 through 5 from all three chips are "wire-or'd" and applied to 3-state buffer U8. If U8 pins 1 and 15 are both low, data from the selected PROM passes through U8 and appears at the output of the converter.

Simultaneously with the appearance of ASCII data at the inputs of the PROMs, the keyboard strobe signal is applied to U1A. U1A and B provide a total strobe delay of approximately 7 microseconds. At the end of this delay period, the strobe signal appears at the output of U2A. When the ABC-1 is connected to a FIFO such as in the UT-4, the delayed keyboard strobe signal causes a "shift in" signal to be applied to FIFO pin 17. Because the data at the output of ABC-1 chip U8 is already present at the FIFO data inputs, this data is entered into the FIFO as a parallel format Baudot character.

The preceding paragraphs describe what happens in the converter when no case shift is required. Let us say that the character converted in the previous example was the character "R". Let us now assume that the next ASCII character from the keyboard is a period. Conversion of this character to Baudot code requires that it be preceded by a FIGS shift character. The states of bits 6 and 7 in the ASCII period character cause PROM U6 to be selected for punctuation characters (numeral conversion also takes place in this PROM). PROM U6 *output* bits 6 and 7 are Low and High respectively for a period character and are applied to the case shift detector latch U9A,B where pin 12 of U9A was Low for the previous character R. Bit 7 is High and so has no effect on the latch. Bit 6 is Low, causing U9A,B to change state, and pin 12 goes High. This Low to High transition is applied to input B1 of 1-shot U10A, generating a 6-microsecond wide FIGS shift gate at U10A pin 4. This gate performs three functions. It inhibits U8, causing U8 outputs to revert to the 3rd (high impedance) state, and because of the current sources through R21-R25, U8 output bits B1, 2, 4, 5 go High. Bit 3 goes Low because of the inverted (Low) output of U2C which is the second function of the FIGS shift gate. The 3rd function of this gate is to generate a "Case Shift Strobe" pulse by means of U3A,B and U2A. This strobe is delayed 2 microseconds by U3A, permitting the parallel data at U8 output (bits 1, 2, 4, 5 High and bit 3 Low = Baudot FIGS shift) to settle to a static condition before being entered into the FIFO by the strobe signal.

So far, approximately six microseconds have elapsed since the ASCII data and strobe for the ASCII character "period" appeared at the input to the converter. At the end of the 6 microseconds, U8 is enabled, and U2C output returns to a high level. At this time the Baudot character for period (B1, 2 = Low, B3, 4, 5 = High) is present at the output of U8. One microsecond later the delayed (7 microsecond) keyboard strobe from U1B appears at U2A pin 11 and now the Baudot period character is entered into the FIFO. Generation of a LETTERS shift character in U10B is similar to the foregoing except that U2C output remains High (U8 outputs B1 through B5 are all High).

Thus it is apparent that all normally converted characters are delayed by seven microseconds within the converter before being strobed into the FIFO. If a case shift character is required, it is generated and strobed into the FIFO during the seven microsecond delay interval.

U11, 12, 13 and U2D form the "Letters shift after Line Feed" circuit. U11 and U12 detect the presence of a Baudot Line Feed character at the output of U8. The output of U12 goes Low when the normal delayed strobe pulse from U1B appears at U11A. After a one microsecond delay through U13A, U13B generates a six microsecond pulse that is applied through U2D and U9C to start the generation of a Letters shift character as previously described. A non-printing character such as Letters shift, following a line feed, gives the machine time to return to the left margin before printing the next character.

In Fig. 2, waveform 11 of the timing diagram is a composite of the various conditions at the converter output strobe line. The "Typed character strobe" (center pulse in the pulse train) will appear on the strobe line every time a character key is pressed on the keyboard. The case shift strobe and LSAL strobe are shown as dotted lines, indicating they will appear only under certain conditions. Depending on previous conditions, all three strobe pulses can appear in the sequence illustrated when the converter receives an ASCII LINE FEED character.

Construction

The timing components should be kept clear of the trigger inputs on the one-shot multivibrators. Five percent tolerance dipped mica capacitors and five percent ¼ Watt resistors should be used in the one-shot timing circuits. Three ABC-1 converters have

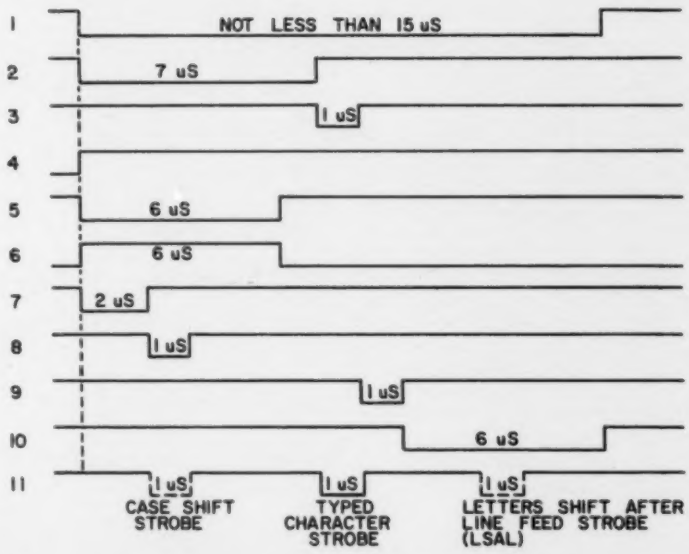


Fig. 2. Timing diagram. 1 – Strobe in, U1A-1. 2 – Strobe delay, U1B-10. 3 – Delayed strobe, U2A-13. 4 – Figs shift, 1-shot U10A-2. 5 – Figs shift gate, U10A-4. 6 – Case shift gate, U10A-4. 7 – Case shift strobe delay, U3A-4. 8 – Case shift strobe, U2A-12. 9 – LSAL gate delay, U13A-4. 10 – LSAL gate, U9C-3. 11 – Strobe output, U2A-11.

been constructed and the timing was well within tolerance using off-the-shelf five percent components.

Use of a printed circuit board makes construction much easier and decreases chances of wiring errors. Even so, the PC board has a high component density and traces are very close together. Great care should be exercised during assembly and soldering to prevent errors in component location, IC orientation, and solder bridges. Sockets or molex pins are recommended for the ICs.

PC Boards and PROMs

EDI[4] has been authorized to make a PC board available for the ABC-1. This is a glass epoxy, double-sided, plated-through hole circuit board. It will fit a standard .156 spring 18-position double-readout edge connector. Boards only, or complete parts kits including the three pre-programmed PROMs, are available.

If you already have a UT-4, Fig. 3 shows the changes required to interface with the ABC-1. If desired, EDI has a modified UT-4 PC board with these changes incorporated. Order "UT-4 IF" PCB/kit. This PCB fits the same type edge connector socket as the ABC-1.

Troubleshooting

Most comments on troubleshooting in the KBI-1 article apply to the ABC-1. The converter is a fairly complex circuit with critical timing parameters. If a scope is not available, it is mandatory that the associated UT-4 be operational in order to check converter operation.

Strobe and data lines from the KBI-1 outputs to the ABC-1 inputs and from the ABC-1 outputs to the UT-4 should be less than 20 inches in length. Transmission line techniques must be used for longer lines as described in the KBI-1 article.

Logic levels at the seven data inputs to the ABC-1 must be stable at the time the keyboard strobe goes Low at U1A-1 and U7-14. As indicated in the timing diagram, the minimum width of the strobe pulse is 15 microseconds. If your keyboard strobe is pulsed with a period, for example, of 5 microseconds, then U14 of the KBI-1 must be used to stretch this 5 microsecond pulse to at least 15 microseconds. Another possible source of improper operation is errors or omissions in the switching and control circuitry (S1, S9) as shown in Fig. 3.

To use the Repeat message function in the UT-4 during operation with the KBI-1/ABC-1, PRELOAD switch S5 is set to PRELOAD, KYBD switch S9 to IN and the message is typed into the UT-4 memory from the keyboard. KYBD switch S9 is then set to OUT and REPEAT switch S8 is set to REPEAT. Then PRELOAD switch S5 is set

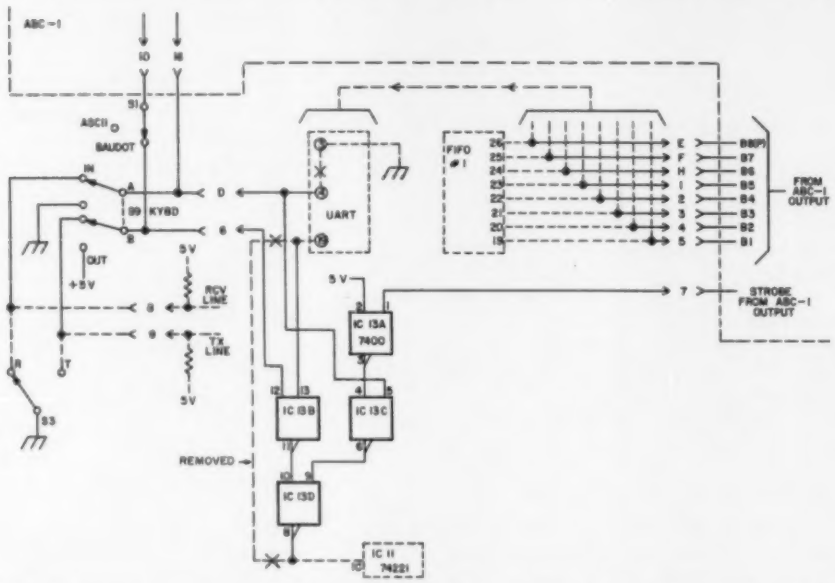


Fig. 3. Changes required to interface UT-4 to ABC-1. Notes: Dotted lines show existing circuits in UT-4. Solid lines indicate added circuitry to accommodate ABC-1. These additions change the UT-4 PCB to UT-4 IF PCB (IF = Interface). ASCII/Baudot switch S1 is the same as S1 in ABC-1 schematic. Keyboard In/Out switch S9 is added to UT-4 control switching. UT-4 IF has all the features of UT-4 except that Space switch S7 is deleted. UT-4 IF edge connector references are for the EDI printed circuit board.

to NORMAL and the message is continuously recirculated through the UT-4. REPEAT switch S8 also permits local copy on your printer during the repeat sequence when using the UT-4 IF circuit board. KYBD switch S9 must be returned to IN if you wish to continue using the keyboard after completing the repeated sequence.

Acknowledgements

In addition to the valuable suggestions contributed by W6FFC and WB6WPX, thanks is due Peter K6SRG, for his many helpful comments and for checking out the first prototype PCB. I am indebted to Steve WA6TVA, for pointing out the need to force the case shift latch to the letters state when auto letters after line feed is generated. Appreciation is also extended to many others who offered suggestions and encouragement, including K2SMN, K3TML, WA5NYY, W6GQC and WA7ARI. ■

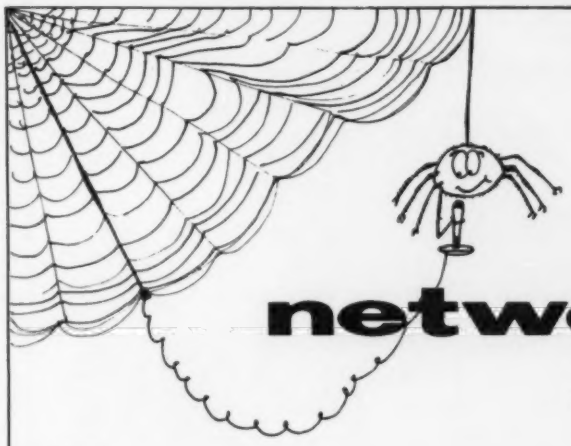
References

[1] Ellsworth, C. A., "Using A Bargain Surplus Keyboard" (The KBI-1), *73*, January, 1976.

[2] Lancaster, Donald M., *The TTL Cookbook*, 1974, p. 153.

[3] Hoff, Irvin M., "The Mainline UT-4," *RTTY Journal*, March, 1975, p. 4.

[4] Electronic Development, Inc., PO Box 951, Salem OR 97308.



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	S	Maritime Mobile Service Net	2000	Daily	14315
	S	Intercontinental Net	2200	Daily	14315
NATIONAL AND REGIONAL					
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US	I	Liberty Net	0300	Thurs	3860
North Central	T	North Central Phone Net	1300	Daily	3915
North Central	T	North Central Phone Net	1800	Daily	3915
US	I	Liberty Net	1800	Sat	14320
Great Lakes	R	Great Lakes After School Net	2100	M-F	3988
STATEWIDE					
MT	T	Idaho – Montana Net	0030	Tu-Sat	3582
IA	T	Iowa 75 Meter Net	1730	M-Sat	3970
MI	T	Michigan Buzzards Roost	2130	M-Sat	3930
NH	S	New Hampshire Emerg. Net	2200	Sat	3945
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My thanks to WB8THQ and WB9PHM for contributing this month. Would someone please tell me about the Southern Texas Country Cousins? I listened to it one day and I can't remember what frequency it is on. I would like to include it in this column. If you check into any net please drop me a line.

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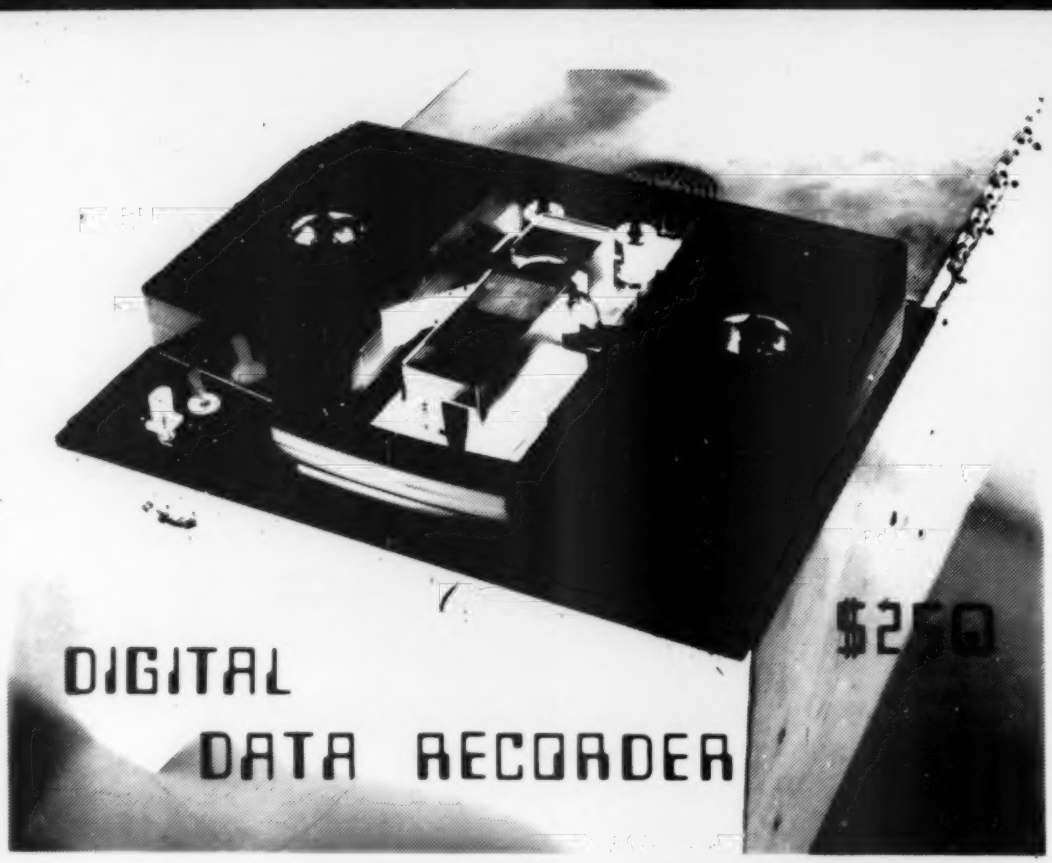

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No, I'm not going mathematical on you. (At least I don't think so . . .) Instead, I'm going to describe how to construct a device which is guaranteed to warm the heart of any red-blooded gadgeteer – a random music generator. This is a full-fledged construction article, so if you're not interested in warming up your soldering iron (You say you don't even own one? What are you doing in my audience?), you might as well skip this article and go read someone else's. But if you like to sling circuits together, then this little number is definitely for you.

Description

The random music generator (henceforth called the RMG) consists of three basic components: the sequencer, the oscillator, and the waveshaper.[1] As you can see from the basic block diagram in Fig. 1, the sequencer provides control signals to the oscillator and the waveshaper, thus determining the note played and the timbre for it.

The sequencer is a special form of shift register circuit known as a Johnson Counter. It is used to produce (almost) random bit patterns. In the RMG, the sequencer is a 12-bit shift register with an exclusive NOR gate acting as a feedback path. Depending on the exact connection of the feedback gate's programmable input, the sequencer can produce patterns of from 18 to 3255 12-bit words. The sequencer is controlled by a clock circuit, a pulse generator which operates in the range of from 1 to 10 Hertz, approximately.

The oscillator circuit is a voltage controlled square wave generator which will play one of eight musical notes (C, D, E, F, G, A, B, C), depending on the state of the seven note selector lines. The oscillator is

The Sound of Random Numbers

divided down in frequency, by a three stage ripple counter, to provide four octaves of range. Eight potentiometers (R1 through R8) are used to tune each note to pitch.

The waveshaping circuits control the timbre (tonal quality) of the note played, and also the stereo effect. Four "voicings" are available. There was no attempt made to tailor these voicings to sound like traditional musical instruments, so the RMG has a definite "spaced-out" sound to it.

Construction

The electronics for the RMG (Fig. 2) is constructed in three subassemblies: the front panel subassembly (which contains the selection switching and the controls), the power supply subassembly (which can be constructed in the chassis itself), and a 2.5" x 6" piece of tenth-inch-grid perfboard which contains all other circuitry. Wiring is point-to-point, as impedances in the RMG are low and therefore stray coupling is not a factor.

My prototype used a hole matrix switch consisting of 144 holes in a 6 inch square of

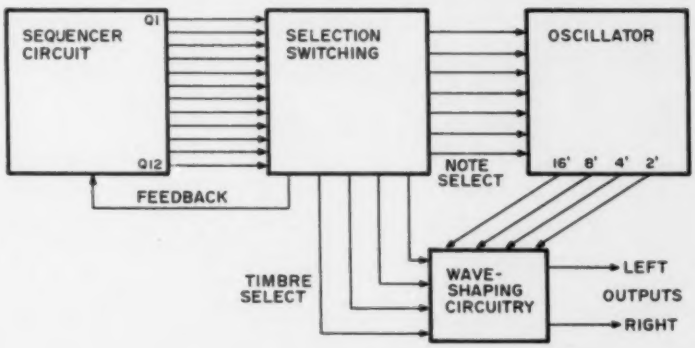


Fig. 1. Block diagram.

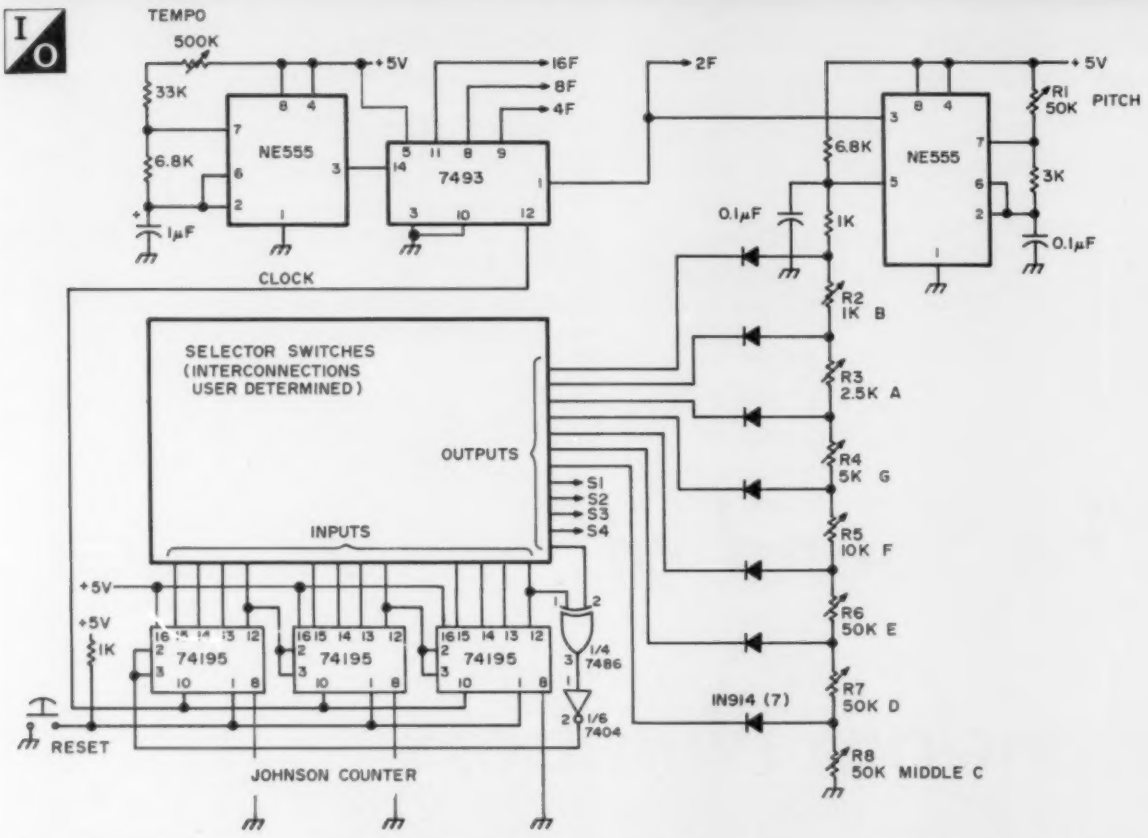
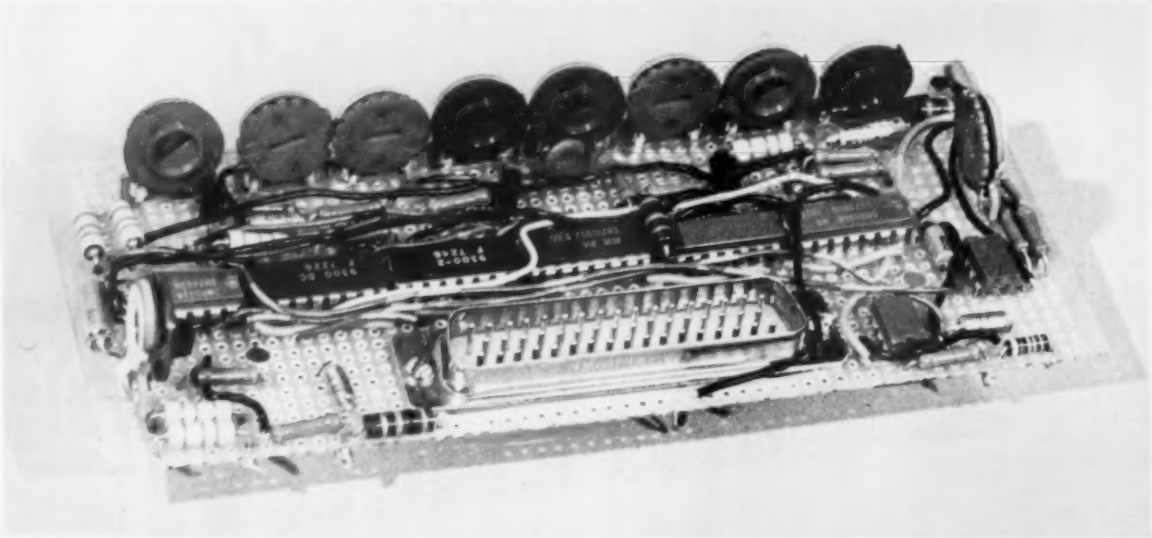
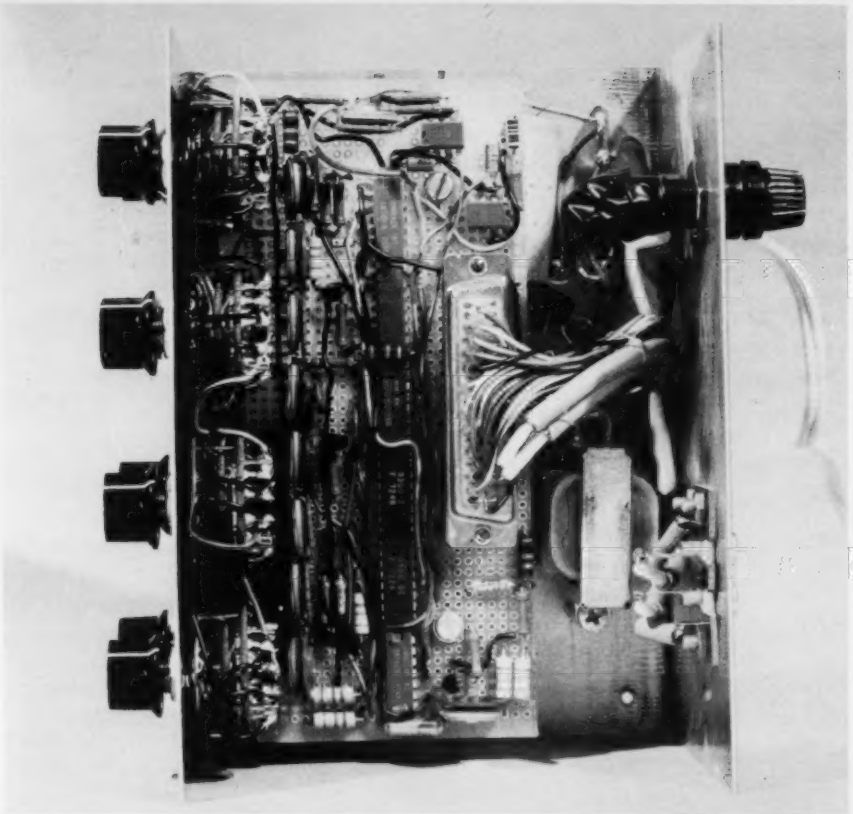


Fig. 2. Schematic.

phenolic. Each hole has two contacts in it, which are shorted together when a conductive programming pin is inserted. The main advantage of this scheme is that the pattern of pins in the phenolic gives a quick visual readout of the program set up. The main disadvantages are, first, that one must be careful not to insert two or more pins in the same horizontal line in the matrix switch (as this will short two or more shift register



Closeup of the circuit board. The trimming potentiometers provide adjustment for the pitch of each note and the output level for each channel.



Inside the RMG: The circuit board is mounted on stand-offs and connects to the power supply and front panel wiring via the cable at the rear.

outputs together, and second, that the assembly of such a matrix switch requires that connections to 288 contacts be made in a very small area. One can achieve the same versatility by using twelve single-pole twelve-position rotary switches (at $2.00 each!) with only 156 connections to be made, or by using two twelve terminal barrier strips and some jumper wires. The terminal strips can be mounted on the front panel, or (more esthetically) on the rear of the RMG. A reasonable compromise between versatility and cost can be realized by "hard-wiring" some choices in the selection matrix and using rotary switches to select others, as was done in the version photographed. The mechanical layout of the front panel is, of course, determined by which selection scheme you choose.

The power supply subassembly can be constructed on a terminal strip, with the exception of the LM-309K, which should be mounted on the chassis itself for heat sinking purposes. This is simplified by the fact that the "309" is so constructed as to make the device's case a ground terminal – thus no insulation is required when mounting it to the chassis. A half amp fuse is recommended for safety.

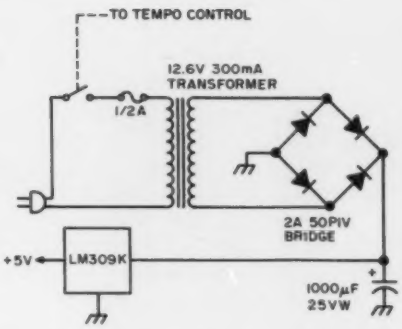


Fig. 3. Power supply. Unless otherwise noted, resistors are ¼ Watt and capacitors are 10 WV.

Table 1.

Note	Scientific Scale (C-256)	Concert Scale (A-440)
Middle C	256.00	261.63
D	287.35	293.66
E	322.54	329.63
F	341.72	349.23
G	383.57	392.00
A	430.54	440.00
B	483.26	493.88
C Above Middle C	512.00	523.25

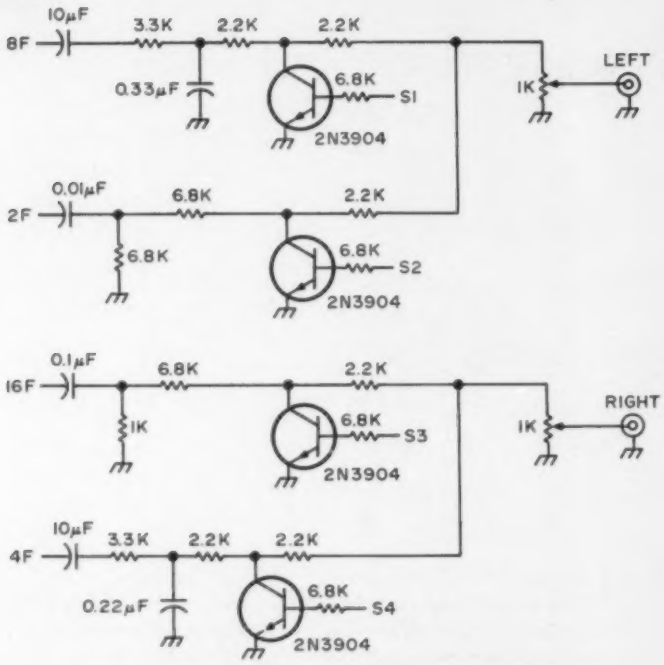


Fig. 4. Switched filters. All transistors = 2N3904.

Back panel and bottom of the RMG. Note the LM-309K mounted on the underside. The phono jacks on the back are the outputs.

Table 2.

Feedback Point	Number of States
Q1	3255
Q2	126
Q3	45
Q4	28
Q5	819
Q6	18
Q7	819
Q8	28
Q9	45
Q10	126
Q11	3255
Q12	not possible

The audio outputs are terminated in jacks which match the cables of the hi-fi you intend to use with the RMG. My prototype used RCA phono jacks. The outputs are low impedance (approximately 1000 Ohms) high level (about 1 volt peak-to-peak), so use compatible hi-fi inputs for best results.

Tuning

Tuning the RMG should be done with care, as the "listenability" of the instrument suffers if it continuously plays sour notes. A pitch pipe or a musical instrument known to be in tune may be used as a reference. Unless you have a frequency counter which reads to .01 Hz (a rare bird indeed!), you must use a zero-beat tuning method. A counter which reads to 1 Hz is not accurate enough for tuning. To tune the instrument, hold the reset button in and program one note at a time to any shift register output. Start with the highest note (C above middle C) and descend the musical scale, adjusting R1 through R8 for zero beat with the reference instrument.

Table 1 gives the frequencies of the eight musical notes. You may tune to scientific or concert pitch, as you please.

Programming

Programming the RMG is mostly a matter of taste. However, a couple of points can be made. First, very short sequences tend to become monotonous very quickly, but very long sequences can become so involved with permutations as to be hard to follow. Second, if you wish to listen to a sequence, pick a long one; if you play an instrument and wish to improvise around a sequence that the RMG plays, pick a short one.

Table 2 indicates the number of 12-bit "words" produced by the RMG for each sequence it is possible to program.[2] ■

References

[1] Lancaster, Don, "Build an Electronic Music Composer/Synthesizer," *Popular Electronics*, February, 1971.

[2] PL/1 Program jc.pl1, written by D. A. Wallace on Multics 2.1.

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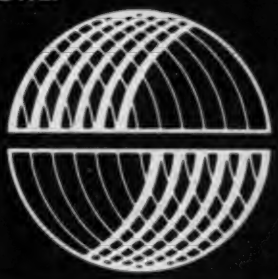

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What Do You Want To Count?

by
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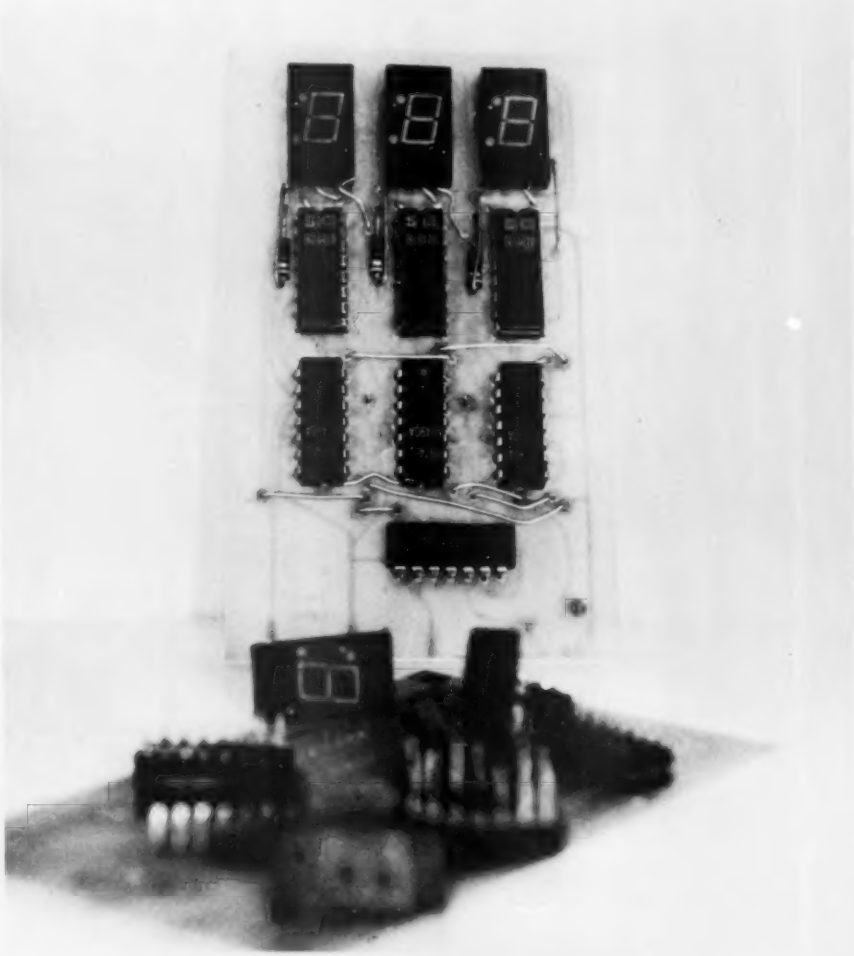
This is a digital world we live in today. Digital readouts are flashing on everything from FM tuners and wristwatches to "meter-less" VU meters. Ham equipment is going digital, too. Readouts are more accurate, readings are easier to interpret, and



All the 3 DCU parts mount on one circuit board.

bent pointers, non-linear dials, and other mechanical problems are eliminated. New, nearly burnout-proof LED readouts with no parallax and ±1 digit accuracy are becoming available at a price that is allowing more and more workbenches to be fitted up with flashing lights where once stood taught-band, multi-scale meters. Since all this digital equipment is obviously here to stay, this article gives you the basics, so you can understand how that new DVM or digital wristwatch works. And, if you already have the savvy on the digital scene, you'll be interested in the 3 DCU. It's three digits of Decimal Counting Unit. It makes a great counter display, DVM display, etc. And you get three digits for what you would expect to pay for only two digits — less than $18.00!

Digital devices are simple, and most operate on the same very simple principles. Digits are counts, and there are any number of counting systems. The most familiar system is based on counting with the ten fingers ("digit" is derived from the Latin word for finger). Since there are ten fingers the system is called decimal (deci = 10). You could use base 20 (fingers and toes) or anything between. Of course, if you use decimal numbers to represent the figures in another system you will have to use some additional symbols, because there are only ten numbers. The hexadecimal system (base 16) uses letters and numbers. A hexadecimal count goes 0, 1, 2, 3 and so on to 9. For 10 and higher you substitute ABCs, like this: 7, 8, 9, A, B, C, D, E, F. Therefore, a hexadecimal C is the same as a decimal 12. Because of the vast number of digital systems, there had to be a place to start in electronic digital equipment and that was two. Simply "on" and "off." The binary system is a "base two" counting system (bi for 2). While being able to make only a maximum count of two might seem like a shortcoming, it is no problem for an electronic circuit to switch on and off a million times a second. That's pretty fast counting!

Okay, so we use binary, count some pulses, then show 'em to the operator. The problem is, it's tricky for a mere human to see those digits flash past a million times per second. The logical answer: Store the count. This is where the binary counter comes into action. We feed it a group of microsecond pulses and then take some time to look at how many pulses were there. The binary counter operates on both the principle of frequency division and storage.

The basic circuit that makes up a counter is the flip flop. A flip flop does just that. First it flips, then it flops. With a little pulse steering it "flips" on a negative pulse in, then "flops" on the next negative pulse. A square wave input has a negative transition every cycle (Fig. 1). It takes two of these negative transitions, or two cycles, to get a flip flop back to the way it started. Thus,

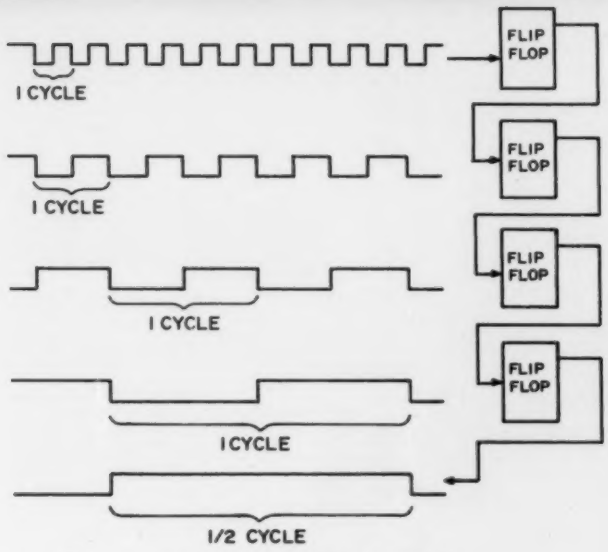


Fig. 1. Flip flops divide frequency.

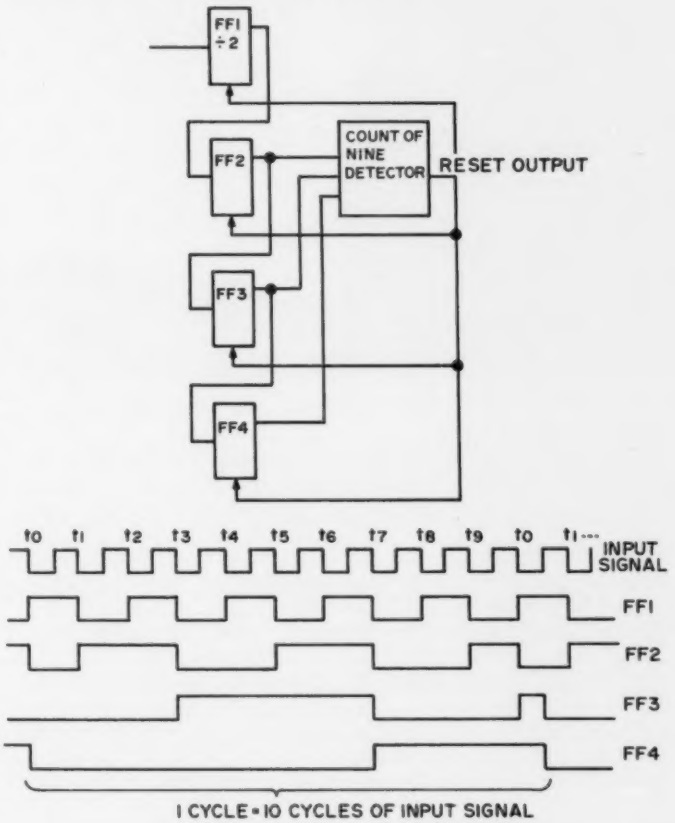
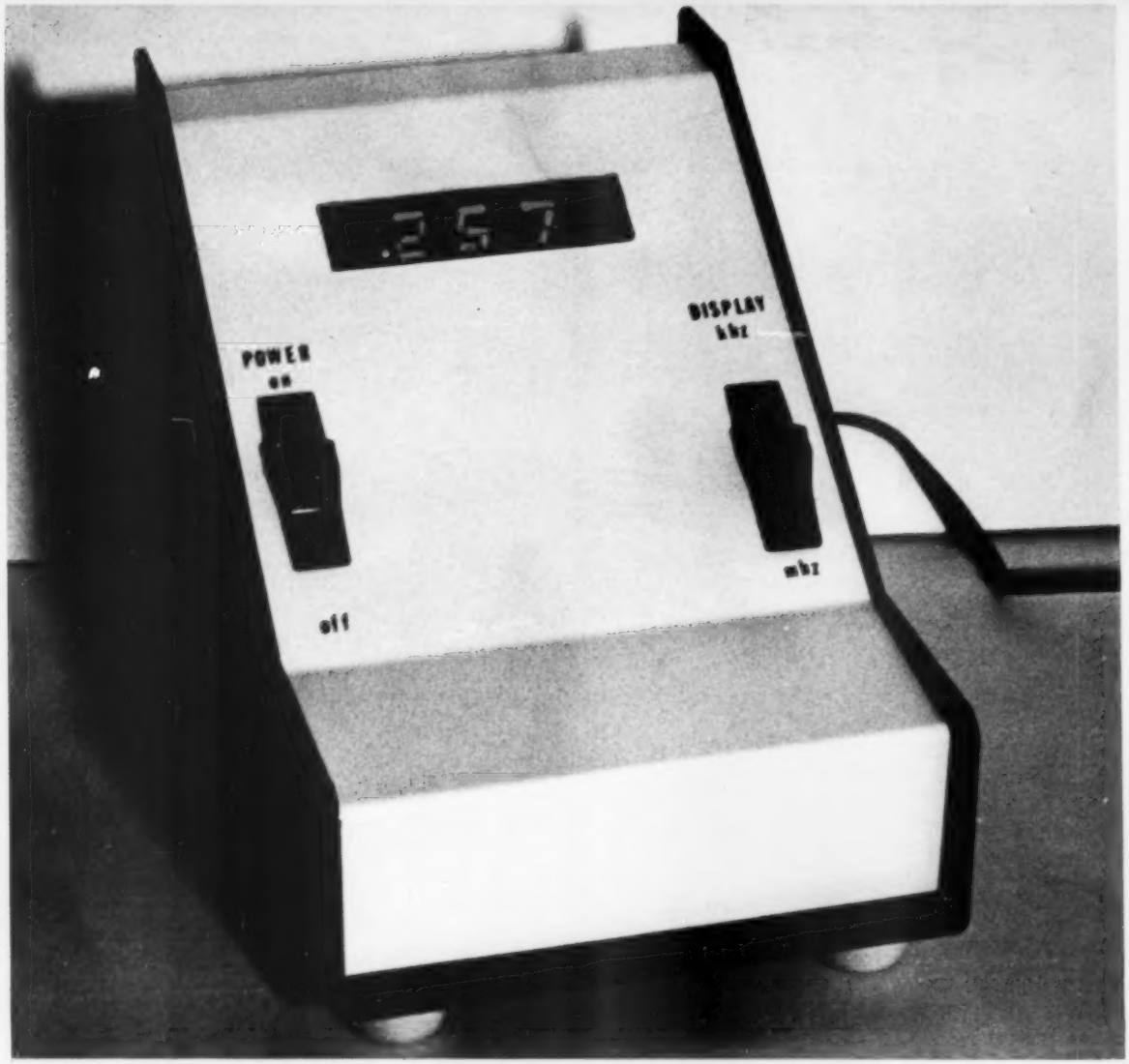


Fig. 2. Counter modified to divide by ten.



Put a 3 DCU in a cabinet with a timing circuit board, and you have an instant 3-digit counter, great for reading out the frequency of your rig.

the flip flop divides the input frequency by two. If the output of that flip flop is divided by two by another flip flop, we have a simple divide-by-four counter. One more stage yields divide by eight. The number of stages is the same as the power of 2. For instance, the 3-stage counter yields 2^3 or divide by 8. A 2-stage counter (2^2) gives a four count. It is also possible to make the counter short itself by a count to allow counting to any base.

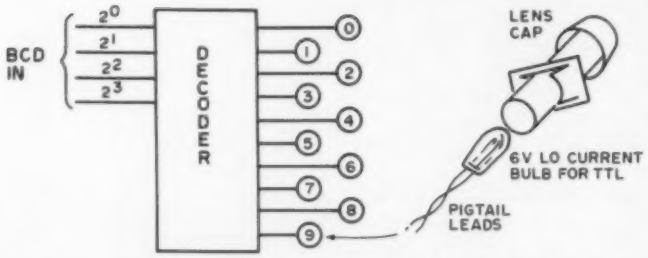


Fig. 3. Using ten bulbs to show numbers stored in digital counter.

Fig. 2 shows one way to modify the count. The four stage counter would normally divide by 16 ($2^4 = 16$). Notice that at time t_0 the output of the counter is reset by the combination of outputs from the stages. The counter will count from t_0 to t_9, then reset and start all over at t_0. This gives divide by ten action. In fact, this counter is called bi-quinary, since the first stage divides by two, and the last three stages divide by five.

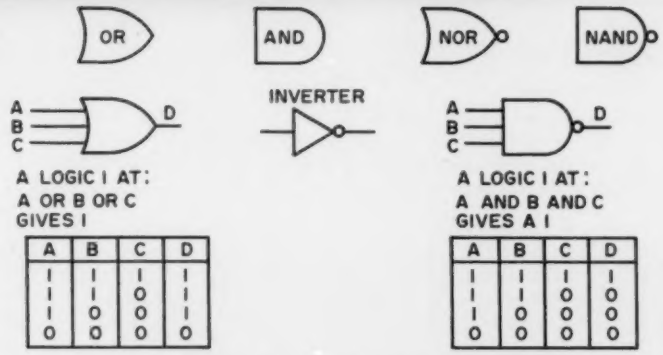
This is the same basic logic used in the popular 7490 divide by ten IC. The output of the counter is not only divided by ten but is BCD. BCD means "Binary Coded Decimal."

That's where the storage capability of the flip flop enters the picture. A lone negative pulse in will flip it (or flop it, if it were already flipped). If no other pulses come along, the flip flops will remain the same and the number of pulses will be stored in a counter. In fact, because of the BCD action, a seven pulse in would give an output from the four stages of 0111 (binary for decimal 7). If the counter is reset and we let in say, thirteen pulses, the stages will flip flop along until they count to ten and then start over again. The three remaining pulses would cause the counter to sit at 0011 (BCD for 3). What happened to the 1 in front of the 3? Simple: It spilled over to the next decade counter if there was one. So, the first counter counts units, and the next one counts tens. With 27 pulses, two decade counters would store 7 (units) and 2 (tens). So putting the first decade on the right and the second on the left would give 2 – 7 or 27. With readouts connected to our counters, we would be able to read our numbers just like the numbers on a written page. Just hook up a light bulb to the stages in each decade for an instant readout.

Of course the readout would be BCD. For 27 that would be 0010 and 0111. That's not too hard to read, if you remember in binary you have only a two digit base – 0 and 1. And think of the action of the decade counter. The counter on the right counts digits and the one on the left, tens. Well, in the BCD system the digit on the right counts units just like in the decade counters. Remember that there are only two counts, not ten, so the next digit to the left counts twos. The next one can count up to two twos (that's four). The last digit is eights. So the BCD 0110 is (from the right) no units, one two, one four, and no eights. Add them up. That's four plus two, or six, so 0110 BCD is 6 decimal. Now it is easy to read the lights and tell what is in the decade counters.

With all the miracles of electronics, it's pretty easy to build something that lights up to ten lights with little 0 through 9's stenciled on. You just look and see a display in decimal as shown in Fig. 3. Decoding the BCD and converting to decimal to light up the digits is accomplished by using a decoder made up of a system of gates.

Just as flip flops store and divide, gates decode and control. There are two basic gate functions and all others are variations of these functions. The two basic functions are AND and OR. The AND gate has to have its inputs applied together to have an output



A	B	C	D
1	1	1	1
1	1	0	1
1	0	0	1
0	0	0	0

A	B	C	D
1	1	1	1
1	1	0	0
1	0	0	0
0	0	0	0

Fig. 4. Logic symbols with truth tables for OR and AND.

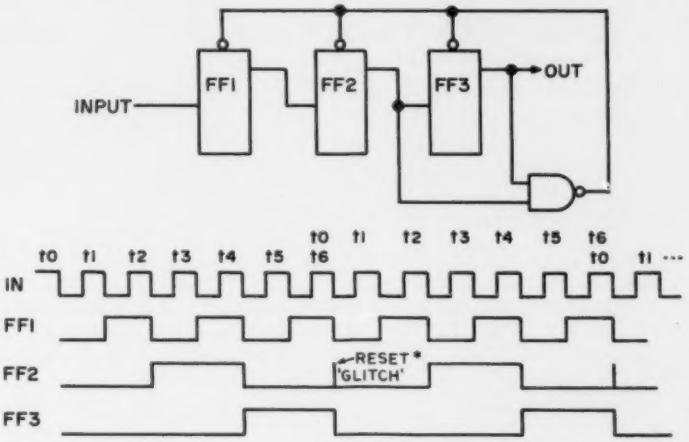


*Fig. 5. Divide by six counter. *Because of the "glitch" at FF2 and fast switching times of some flip flops, you may get FF3 flipping again. You may suppress the glitch or divide by a non-reset flip flop at the end of the counter. One of these, followed by a decade (÷10), gives a one second output from the 60 cycle ac line.*

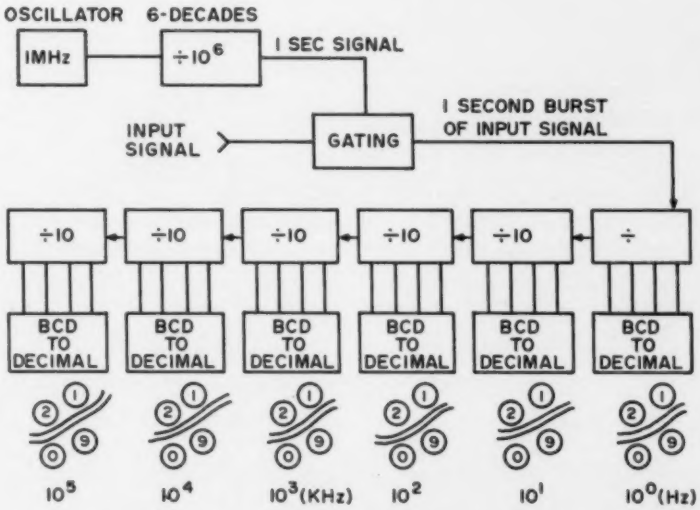


Fig. 6. Basic counter block diagram. Frequency readout in Hertz.

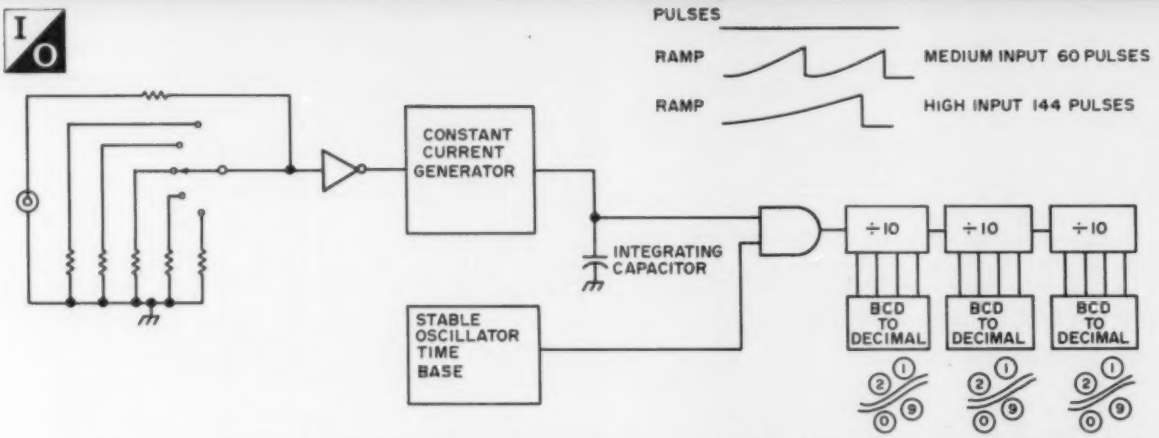


Fig. 7. Basic slope integrating DVM, showing some relationships between the slope wave forms and the timing pulses.

(an "output" and "input" are considered a logic 1, or positive voltage). The OR gate takes one input "or" another "or" any other to get an output. An inverter (common emitter amp) following either of these gates inverts it and you get NOT AND or NAND and NOT OR or NOR. That means a one AND a one give a zero and a one OR a one give a zero. It's upside down logic but it comes in handy. To abbreviate the circuit you use the logic symbols shown in Fig. 4.

Now let's take a three stage (divide by eight counter) and do some fancy counting. To divide by six we need a count of 101 (binary equivalent of five) maximum – then when the count hits 110, six, we want to reset the counter to zero. So, simply use a two input NAND gate (it takes a zero to reset our counter stages). You end up with Fig. 5. That's a good beginning for a clock. Just divide by six, then divide by ten for one second outputs from the 60 Hz ac line. Just hook up the decade displays and you can count the seconds. If you modify the decade displays so the second one from the right counts to six and then resets, and the fourth one from the right does the same, you will count up to 60 seconds and spill over the next two digits to the next counter pair (in which the far left digit only counts to 2). At 11 hours 59 minutes and 59 seconds, your clock reads noon (or midnight) and one second later all the counters go to 00:00:00. You can eliminate the seconds readouts in a practical clock, but you have to keep the divide by ten and divide by six counters to feed the minutes counter.

The digital clock is obviously pretty simple. How about a counter? That's somewhat more complicated, but only because of

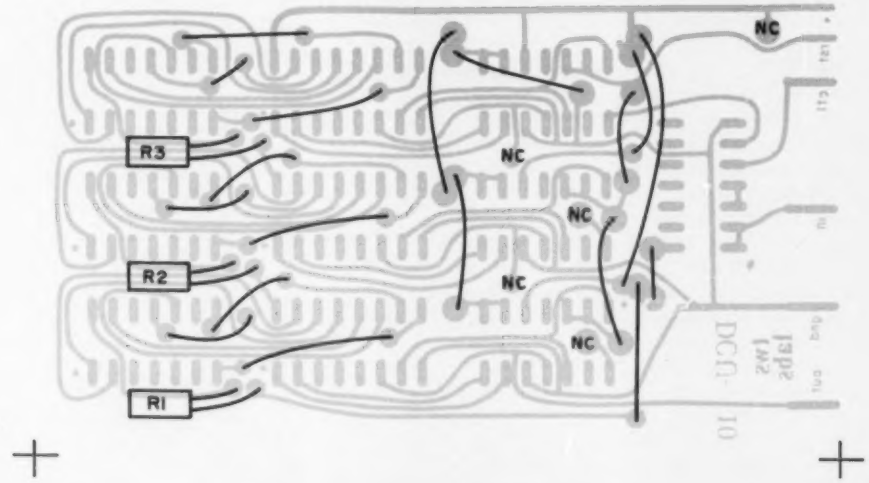


Fig. 8. Jumpers and IC alignment diagram.

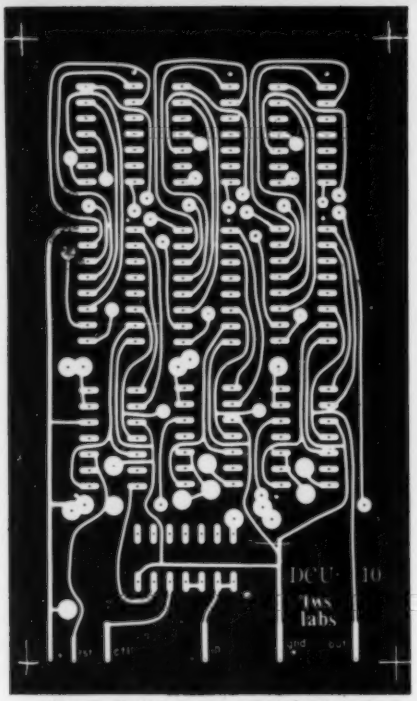


Fig. 9. Foil side, PC board (full size).

the gating. This time we will consider the gate controlling function as well as its decoding function. Fig. 6 shows very simply how a counter works. For one second the gate is "open" or enabled, and the decade counter stages divide away. At the end of that second the gate gets closed and the decade counter stages sit and hold whatever count came in. If the input was, say, 7174 Hz, those are the numbers that will show up on the display – because in one second there were seven thousand one hundred and seventy-four negative transitions counted. Obviously, the accuracy of the one second gating signal is important; that's why you are likely to use a 1 MHz crystal oscillator, divided by a million (6 decades), so any errors are divided by a million, too. You must also reset all the display counters just before you start counting. Otherwise, the first time the counter will show 7174 Hz and the next time 7174 more, so the display will show 14348 Hz (unless you run out of digits). You can see, too, that the gating signal could be 10 Hz; now you can count to a tenth of a cycle for super accuracy. The gating signal can be faster than one second, too. A 1 ms signal will display kHz. Selecting the length of timing signal (and where to put the decimal) depends on how many readouts you have and the maximum operating speed of the gates and counters. A basic counter contains a timing circuit, gating circuit, gating, and displays.

How do you get a DVM? There are a couple of methods. One is simply controlling

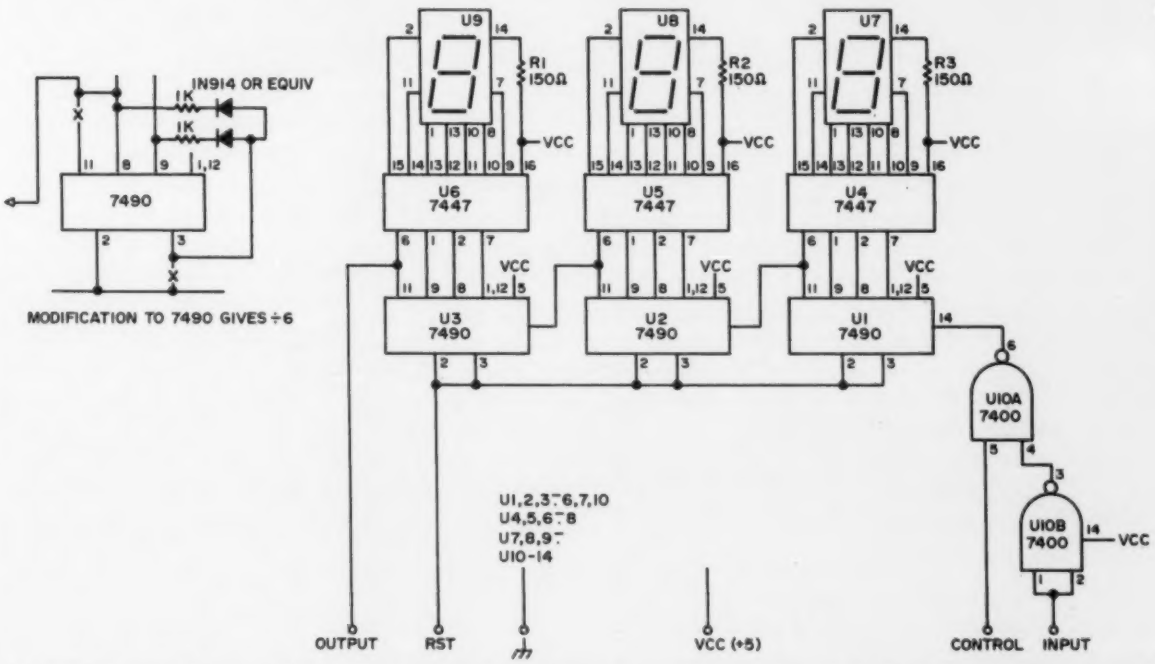


Fig. 10. Schematic diagram with modifications for clock and counter applications. Note: Link all pin 3s on 7447s and ground, for blanking readouts during count in counter if desired.

1. Insert wires through top of board (Fig. 8) for top 1/3 of board.
2. Check to insure no two wires cross and no wires cover or cross IC pin holes.
3. Stick in readouts and 7447s to hold wires in place while you turn board over and solder wires in place.
4. Solder in only 7447 ICs and trim wire leads. DO NOT SOLDER READOUTS IN YET. Make sure 7447s are in right-side-up before soldering.
5. Insert and trim the three wires in the middle of the board.
6. Insure wires do not touch, and solder and trim.
7. Insert wires in the lower third of board; make sure there are no wires touching or crossing IC pin holes.
8. Solder, trim, recheck for wires touching.
9. Insert 7490s and 7400 gate; observe markings to keep from putting ICs in upside down.
10. Solder in ICs and prepare to mount readouts.
11. Insert readouts.
12. Put board against flat surface foil side up and push readout pins down until readouts are aligned and are even with tallest ICs on board.
13. Solder only pin 1 and pin 8 on each readout.
14. Turn board over and readjust readouts as necessary to make the surfaces line up with each other.
15. Carefully turn over and solder the remaining readout pins.
16. Run jumpers on foil side of board from pin 14 on one IC to pin 11 on the other. Allow one side of the wire to stick roughly 1/8" through front of board – this will become a test point.
17. Make sure jumpers clear all pins on foil side of board. Solder jumpers.
18. Run two approximately 2" long insulated wires from the guide hole and pad near the board + 5 input terminal.
19. Connect each wire to the pad that connects the bottom of R2 and R3 (Fig. 8) to pin 16 of their respective 7447s.

Table 1. Step-by-step construction.

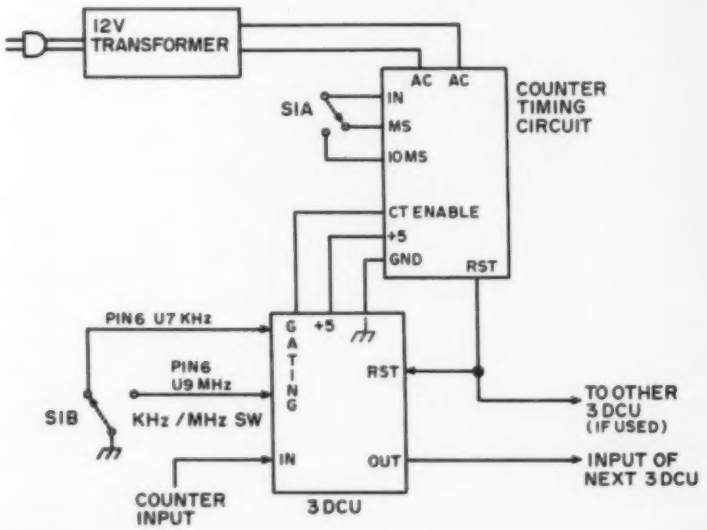


Fig. 11. Connecting a 3 DCU for a nearly 30 MHz 3-digit counter that can read out a transmitted frequency to 100 Hz. Adding the other DCU makes a 6-digit counter that will indicate to 200 MHz with a preselector.

the frequency of an oscillator with a voltage – a VCO. The better method, one you've probably heard of, is the slope integration method. You merely control the output of a constant current generator with the input voltage. The constant current generator feeds a relatively large capacitor. The capacitor either charges in a hurry (large input voltage) or trickles (low input voltage). The charging of the capacitor generates a ramp voltage. The ramp turns on a gate and the gate stays open as long as the capacitor charges. While the gate is open, a timing signal puts pulses through it and the decade counters count and display the pulses. Fig. 7 shows the basic circuit and wave forms for a "slope integrating" DVM.

Well, by now you're probably ready to try your luck at some digital beauty. You may not be too excited about the ten light bulbs for a readout, so just use the popular seven bar types. The seven bars are decoded to shape the forms of numbers 0 through 9. A decoder is available for them and even contains drivers for the LEDs in the 7 segment readout. The decoder is appropriately called a BCD to 7 segment decoder/driver.

The 3 DCU project uses 7 segment readouts and IC decade counters for compactness. The entire three digits fit on a 2" x 4" PC board. A single sided board was used to allow versatility. You will have to run a few jumpers (or use the diagram showing the jumpers for the standard DCU to lay out a pattern for the other side of your board, if you don't want a special application). You can etch your own cards or buy one already etched and drilled. In fact, you can get a complete kit of parts from TWS Labs, PO Box 357, Provo UT 84601.

Begin construction by putting in the jumpers as shown in Fig. 8. Step-by-step assembly instructions are given in Table 1 for a foolproof assembly. Fig. 9 shows the PC layout (foil side). Fig. 10 is the schematic.

After assembling your 3 DCU, check out operation by connecting +5 and ground. Run a ground to RST, and then touch a ground on and off the input terminal of the card. The digits should flash away. If you could actually touch only once, you would be able to count the times you touch the ground. The decades will count up to 30 MHz and, though you may think you touch only once, chances are you will touch the ground many times and the decades will tick away. As long as they count pulses, you will know the 3 DCU is working. Test reset by removing its ground – the 3 digits should go to zero.

Applications

The applications for 3 DCUs are nearly

unlimited: For example, they will work to 200 MHz with a preselector. A pair of 3 DCUs side by side gives a 6-digit counter. An FET, UJT, and time base, along with a 3 DCU, will make a great DVM.

Counter

Currently, there is a timebase and power supply kit available from TWS Labs that makes a great counter for ham rigs when used with a 3 DCU. Fig. 11 shows how to hook up the timebase. With two 3 DCUs and the timebase, you can have a 6-digit 20 MHz counter.

Timer

Obviously, 3 digits are perfect for a 10 minute timer for ID purposes. You modify the middle digit to divide by six instead of ten (see Fig. 10). Now merely feed the DCU with one second pulses. This can be ÷6 and ÷10 the ac line or ÷ million a 1 MHz crystal. Just use an n/c push-button switch to keep the reset line grounded. Thus, when you want to reset the clock to 0:00, you just momentarily depress the switch. As soon as you let up, you remove the reset and the 3 DCU starts ticking off the seconds again. Fig. 12 shows a 10 minute ID timer set up using 3 DCU. A kit to make a 10 minute timer with power supply and warning lamp is also available from TWS Labs. All you add is a 3 DCU.

Clock

Add one more 3 DCU (modified for 6 count as mentioned before) to the 10 minute timer circuit, and you have a digital clock. Fig. 13 should give you some ideas on how to hook it up for 12 or 24 hour operation. For a clock you must have a way to set the time, so a fast advance and a hold position are used. You merely advance the clock slightly past the desired time and then hold the count until WWV beeps, or whatever; when you let up, the clock starts ticking away the seconds. A clock addition is also available from TWS Labs.

DVM

This one will take a little experimenting on your part because the only kit available is for converting a frequency counter to a DVM. If you are using the timebase kit with your 3 DCU, it may work. It is available for $9.50 from R. S. Stein, 1849 Middleton Ave., Los Altos CA 94022. (Note that this is a PC board for the DVM only.) If you want to experiment, you might try Fig. 14 for ideas. If you allow your 3 DCU to trigger an external flip flop and drive an LED, you will have the makings of a 3½ digit DVM. Once you are measuring volts, it

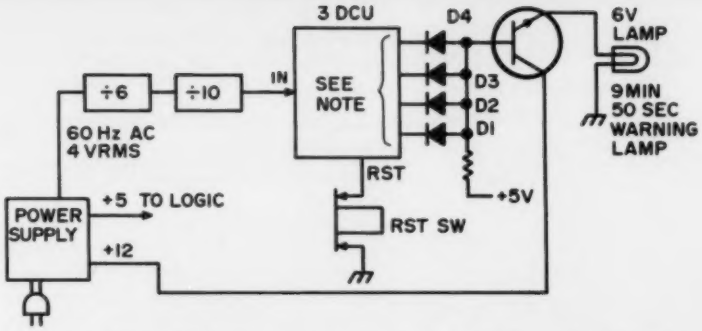


Fig. 12. Hook up 3 DCU as a 10 minute ID reminder. Warning lamp goes on at 9 min 50 sec, for 10 seconds. Note: D1 = pin 8 U1; D2 = pin 9 U1; D3 = pin 1 U3; D4 = pin 11 U3. U2 modified to ÷6 (see Fig. 9).

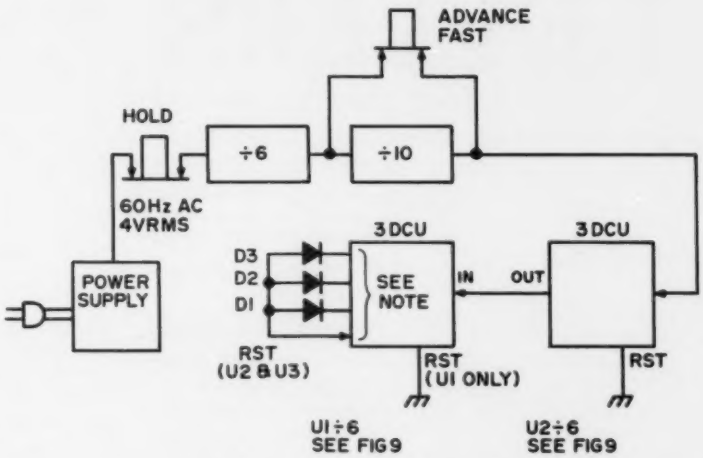


Fig. 13. 12 and 24 hour 6-digit clocks using 3 DCUs and simple fast advance and hold switching. Note: For 12 hour clock, D1 cathode = pin 1 U3; D2 cathode = pin 8 U2; D3 cathode = pin 1 U2. For 24 hour clock, D1 cathode = pin 8 U3; D2 cathode = pin 9 U2; D3 not used.

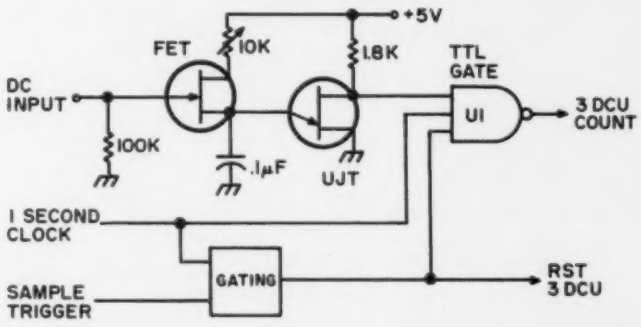


Fig. 14. Here is a place to start. For a simple DVM, the FET current charges the capacitor in the UJT relaxation oscillator. Then gating allows the 1 sec clock to enable gate U1. Then, depending on the frequency of the UJT, pulses will pass through gate U1 and be counted in the 3 DCU. Make it so 1 volt equals 100 pulses into the DCU.

will be easy to measure current (voltage dropped across a standard resistor), Ohms (standard current through the unknown resistor), ac (using a rectifier system), etc.

Well, I'm sure you found one or many ideal projects for your ham shack using a 3 DCU or two. I have several units around the shack and they are all as handy as can be. Although we've only scratched the surface, some of you will probably add preselectors to your counters for 200 MHz operation. Use 3 DCUs for counting dial pulses – only you and your imagination know for sure. For whatever the use, you'll enjoy entering the fascinating world of blinking digits. ■

	Parts List (refer to Fig. 10)
R1,2,3	150Ω¼ resistor
U1,2,3	7490 decade counter-TTL
U4,5,6	7447 BCD to seven bar decoder/driver
U7,8,9	Seven bar readout Opcoa SLA 1 or equivalent common anode
U10A,B	7400 quad, 2 input NAND gates (only two used)
PC board	PC board for 3 DCU available for $2.50 ppd. (See below for address.)
*Kit	Complete kit of all parts, including PC board, all ICs, instructions, and readouts, as well as applications for 10 minute ID timer, stop watch, digital counter, 6-digit clock, etc., is available for $17.99 plus postage from TWS Labs, PO Box 357, Provo UT 84601.

LETTERS

ou goons don't ever proofr
l asy
b
bi ch f rocks
you ignored my
I insist that you print ev

from page 4

like 2 meter ham gear. I bought a 45 and now want a 65. Bought a Multi-2000 and now they have a Multi-5000. Ah, well – guess that is the price one pays for not waiting to see what the market will offer in the future.

Keep up the good work with the magazine.

Carl Hattan KØBZV/KL7
Cold Bay AK

Don't Forget Our Gals

This is my first subscription to *73 Magazine*. This is truly a fantastic book. I am not a ham operator, although I would like to become one. I just enjoy electronics and hobby work. I am not that advanced in electronics, but I enjoy very much reading and learning about ICs and how they operate. Keep up the good work fellows – you have a good thing going.

James Cox
Lumberton NC

Walk on Water?

The reason that I'm writing to you is that the November issue of *73* has just arrived and I have this tremendous pressure to congratulate you. It's been a long time since 1960, Wayne. So – my most sincere admiration and best wishes! I think you are ready to walk on water – barefoot. And thanks from my Novice friends for your books, tapes and the magazine.

Ken Cole W7IDF
Vashon WA

African Report

I thought I would drop you a line to say I have really enjoyed your *73 Magazine* since finding it in the BX. I had a Novice ticket a couple of years back. Since I have started to read your magazine, my interest in amateur radio has been reawakened. I have taken the Conditional test and now I am waiting on the FCC to reply. I would like to see some articles on the new Heathkit HW- and SB-104s, in addition to more on the HW-7. My only other point is, how would you like to be in Addis Ababa, Ethiopia, at 9000 feet with excellent signal reception, and not be able to operate due to government restrictions? Anyway, I do listen to all those rare African stations – and wish.

Carl L. Moss
Addis Ababa
Ethiopia

P.S. Saw *73 Mag* on sale in Athens, Greece in August at various newsstands.

Denver Dining – Etc.

I think it would be nice if you would sponsor a US-wide ham meeting and luncheon directory.

Denver has two open clubs and two weekly open luncheon groups, and many other cities have the same. Many hams would work their travel itineraries around in order to attend some of these groups if they could know where and when in advance.

I would appreciate it if you could put a small notice in your magazine of the "Hams East" and "Hams West" luncheon groups in Denver.

Both meet in cafeterias, start at 11 am and continue until the last ham leaves. No programs, no formality. Just lots of good rag chews. Wives are welcome and many attend.

"Hams East" – Tuesdays, 11 am, Wyatt's Cafeteria, 2466 S. Colorado Blvd., Denver CO;
"Hams West" – Thursdays, 11 am, Wyatt's Cafeteria, Alameda Ave. and Wadsworth (Villa Italia Shopping Center), Lakewood CO (Denver's largest suburb).

Big plans are being made for the 1976 convention, and since everyone seems to get to Denver sooner or later and we really believe in welcoming strangers, don't overlook our two weekly ham luncheon opportunities. The 146.07 T – 146.67 R Castle Rock Repeater Group repeater exists for the sole purpose of rag chewing. All breakers are recognized; traffic information, road and street directions, phone patches, traffic, and what have you is handled and never a discouraging word. We do not put up with smart aleck guys who object to what type conversation or use (it must be legal) our repeater is used for. Our only insistence is that all breakers be recognized and rag chews cease until the breaker's inquiry or needs are met.

Remember – pass the word – 146.07 T-146.67 R is an open repeater with a 3 minute timer and visitors and their needs are at the top of our priority list. Above all, don't be afraid to "break." We expect you to, and, should anyone experience any discourtesy, the matter will be positively dealt with by the group members. I am glad to say that this situation occurs so rarely on this repeater that I can't even recall the last time, and we all hope the last time was truly the last.

Howard A. Moore KØHPF
Lakewood CO

HP-45 Fun (Cont.) (Cont.)

I have been reading *73s* for several years and this is my first attempt to write and say just how pleased I have been with the magazine. It's just plain fine. Keep it up.

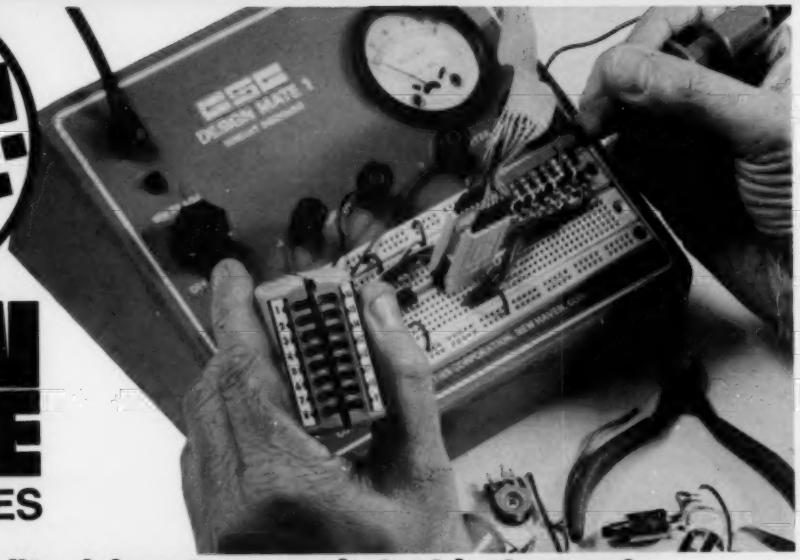
In regards to the article that appeared in Letters (October 1975 issue) entitled "HP-45 FUN," the gentleman tells how to call out the timer mode on the HP-45. Well, this is all fine and dandy, BUT it has one major problem in that the timer runs slow (not 60 counts of the timer = 1 minute in real time). I've made several checks with the HP-45 vs. WWV and a counter, and found the HP to run about 14% slow. I've also checked other HP-45s and they seem to be the same way.

Just thought this info may be of interest to the readers, and users of the HP-45.

William Christian WA5KLK
Beaumont TX

NEW!

THE DESIGN MATE SERIES



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RTTY Autocall - the Digital Way

by
L. W. Sanders VE6BV
2404 37 St. S.W.
Calgary
Alberta T3A A39

As earlier versions of a character recognition device were called "Selcal," it would only follow that newer versions would be called "New Selcal." However, I will stand on the name character recognition device, for that is the only correct way to describe the following unit.

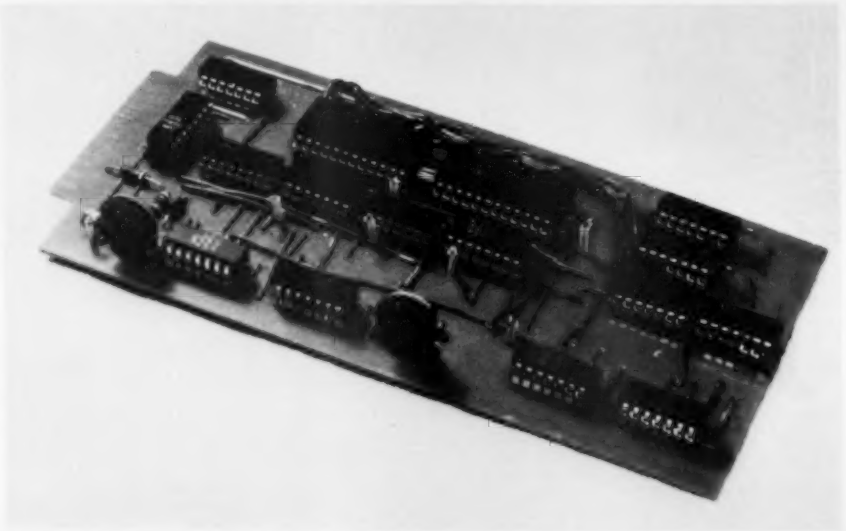
Most previous Selcals had long and detailed methods to decode one character at a time, then another character, and so on, by means of gates, inverters and such. This unit decodes all letters of the alphabet as well as all machine commands, by means of its inherent design. All that is required to change a decode structure is to move 4 wires. Decode can be changed in less than 3 minutes and without paper, pencil, or decode charts, etc.

Again, earlier Selcals used transistors, diodes, ICs and many resistors and condensers. This unit uses ICs, 4 resistors, 2 condensers, and 1 diode. Size again was something else. Some boards that I have seen were 12" x 12" = 144 sq. inches, others, 8" x 8" = 64 sq. inches. The newest CRD (3" x 7" = 21 sq. inches), is fitted with a 12 pin edge connector and will fit inside a Hal ST6 teletype demodulator nicely.

This new CRD includes (as do the Selcal units) such features as the $\overline{\text{NNNN}}$ shut down, force on/off, and four character decode.

A second feature has been added, with which I will now blow some minds.

For most amateurs the acquisition of a model 28 teletype unit and its stunt box is just a dream, but take heart, for with the STUNT BOX CRD unit, the lowly model 12, 14, 15 or 19 can now have the stunt box features of the 28.



Mother board, top view.

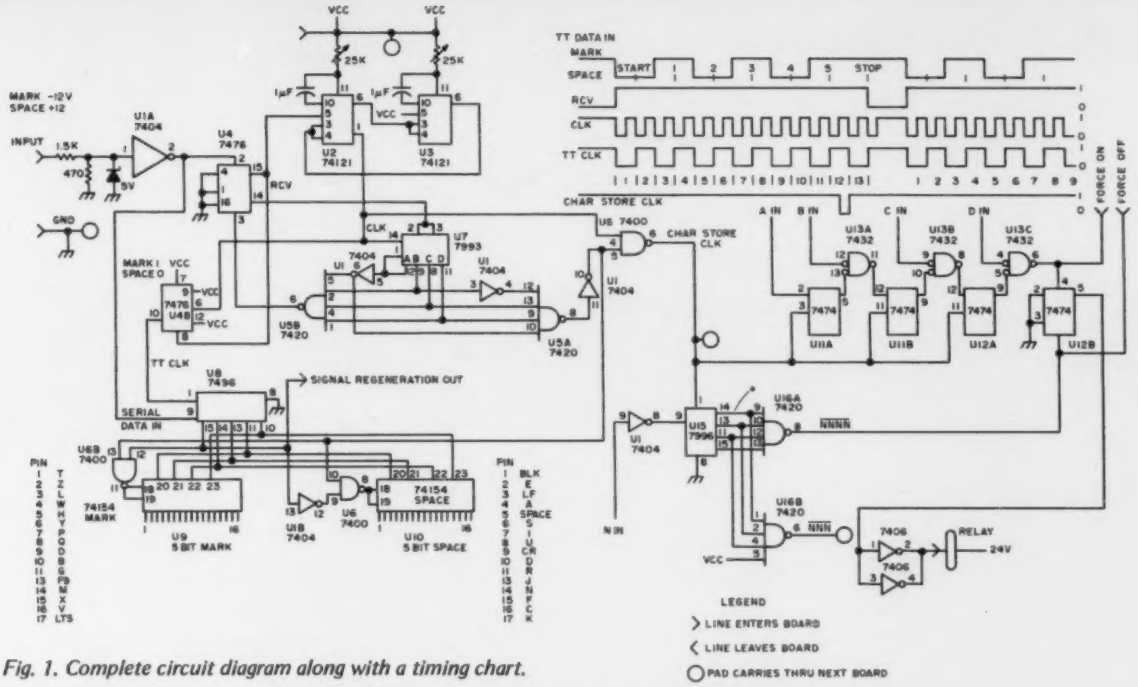


Fig. 1. Complete circuit diagram along with a timing chart.

The model 15 that I own is just about as loaded as I could make it, but I still needed more functions, for station accessories such as keyboard-operated perforated turn on/off and T.D. turn on/off transmitter control.

When a 100 wpm machine becomes available, I will use an electronic speed converter and the CRD to allow incoming signals to change speeds for me.

Also in this area, hams may have the opportunity this winter to access a minicomputer via a 2 meter transmitter to a terminal station, then again via RTTY to the computer, thus needing auto transmit, shut down and ID on the terminal station. The CRD stunt box will do it for us. 'Nuff said.

All this, remember, is in a 3" x 2" x 7" cube still inside an ST6 cabinet.

As an active autostart frequency exists in the western area of Canada and the northwestern United States, and there is a lot of traveling in my work, I would find, upon returning home, a large amount of paper to be inspected and possible queries to be answered.

A selective calling device had to be installed. After looking at many different designs I made an attempt to build one. A RTTY Selcal with TTL logic only met with dissatisfaction and an unstable decode system. After approaching Cal W9ZTK, he suggested a new approach to the decode trouble; a CRD with TTL logic was begun. This unit further reduces the number of integrated circuits required, plus it appears to have several most desirable features as well.

As to the ease of changing decode structure, having just received a new station call, I timed myself. It required 3 minutes to set up a total new decode structure.

In the photos a hand wired board is shown as well as a finished mother board. The hand wired unit was made up to test a stacked board concept and still only have one edge connector. It worked, and this opens up a new idea. How about a stunt box as well as a CRD? Herein lies an article.

A complete circuit diagram along with a timing chart is given in Fig. 1. When going through the theory of operation, check Fig. 1 or the individual circuit drawings, which will assist in understanding the operation of this unit. Some logic levels are given, in particular, on the shift register, character recognizing drawing.

The following approach to a selective calling device is unique. First, all 32 keyboard signals can be detected and used in the decode sequence. There is no need for charts, truth tables or what have you. One wire from a character output to decode input is all there is needed.

Liberal use of TTL logic circuits has all but eliminated any chance of the unit not operating, as well as keeping the cost down. In fact, there are only four resistors, two condensers, and one zener diode on the board; of these, two resistors and the zener are interface components.

The CRD is usable as a selective calling

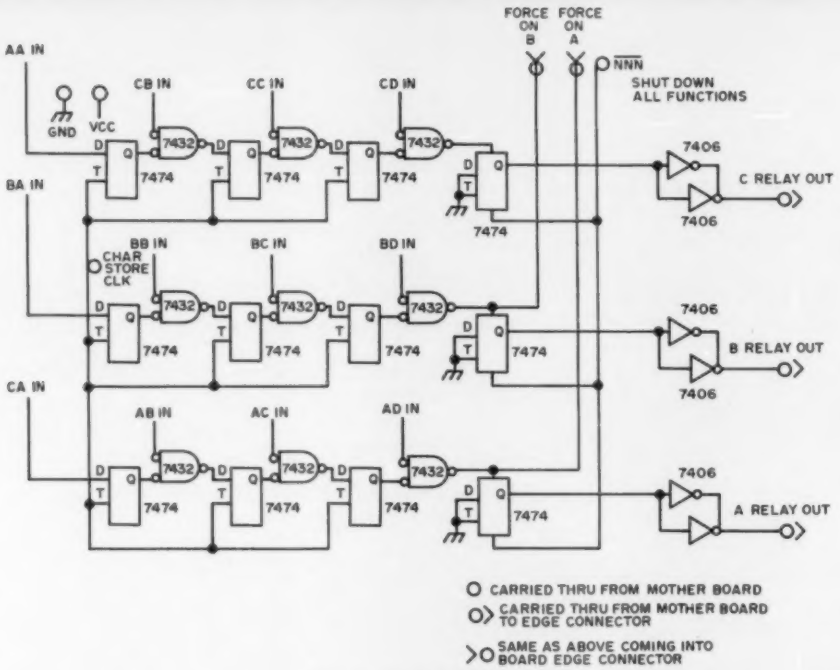


Fig. 2. Stunt box board.

The CRD is usable as a selective calling device as well as a local stunt box at the same time . . .

device as well as a local stunt box at the *same time.* This itself is new. In fact, the whole thing is new.

Theory of Operation

The incoming TTY signal (data) is the standard FSK line. This line is going from 12 volts minus (mark) to 12 volts plus (space). This voltage is applied to a voltage divider comprised of a 1.5k and a 470 Ohm resistor. A 5 volt zener diode is placed in shunt with the 470 Ohm resistor. This limits any input signal that is greater then the proper TTL input level. Output of the inverter is fed to a 5 bit shift register, as well as a control flip flop.

Control Flip Flop

This half of the flip flop controls the start or stop of a stable clock. As the space data comes in, it is inverted in U1a putting a low on pin 2 (set) which causes pin 15 to go high where it will stay until a clear pulse comes along, to change the state of the flip flop. The high on Q pin 15 is fed to the enable pin of a monostable multivibrator or clock.

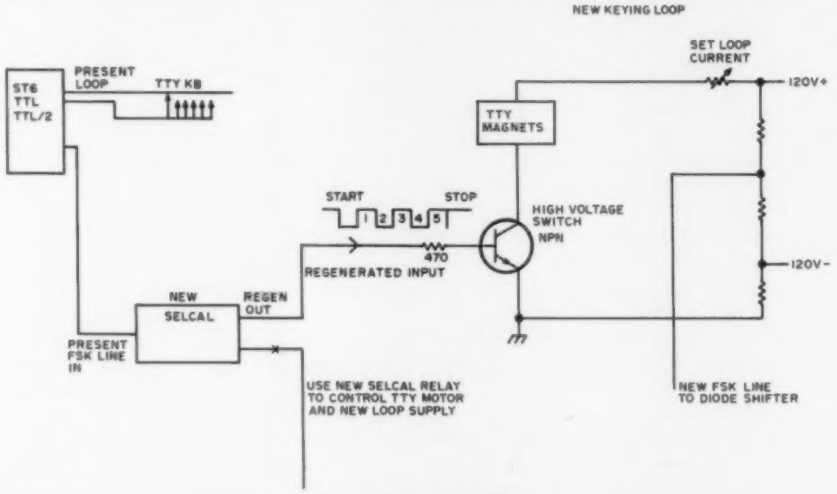


Fig. 3. Station interface.

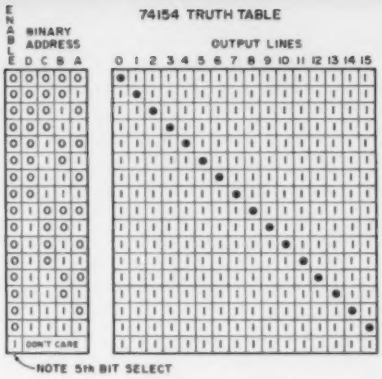


Fig. 4. 74154 truth table.

Clock

This clock is very stable; temperature and supply voltage changes appear to have little effect on its frequency. As the control signal is applied to the Schmitt trigger input (pin 5) pulse, triggering occurs at a certain level of rising voltage on this pin. When the monostable fires, the output pulse width is independent of the input pulse signal. The output pulse width is controlled only by external timing components, in this case the 25k variable resistor and the 1 uF condenser. The output pulse from U2 (pin 6) is fed to U3 (pins 3 and 4). As the Schmitt trigger input is tied to Vcc the second monostable is fired as soon as it gets a negative going pulse from U2 (pin 6); here again output pulse width is independent of input pulse width, being again controlled by the 25k variable resistor and the 1 uF condenser. The output pulse of U3 (pin 6) is fed back to pins 3 and 4 of U2. Hence a train of pulses are generated and will run on forever or until U2 (pin 5) enable is taken to ground or low. *Notice:* There are two timing pots on this clock. One pot sets the pulse width or time on and the other sets the pulse repetition rate or off time. The clock signal is 5.5 ms on and 5.5 ms off for 60 wpm. The output clock signal is fed to a divide by 16 counter, a divide by two, as well as a gate.

Divide by 16 Counter

When the control flip flop U4 starts the clock, Q pin 15 is high; therefore, pin 14 is low. This signal is applied to pins 2 and 3 of the divide by 16. This enables (pin 1, U2) allowing the clock pulses coming in to be counted. When the count twelve is reached, gate U5a changes to a low which is inverted by U1b and applied to one input of NAND gate U6a. As the other input to NAND gate U6a is coming high at this time, a negative going pulse is formed. This pulse is used to clock the character store. As the clock U2 (pin 1) is still running, at this point U7 continues to count. At clock pulse 14, gate U5b detects all highs at its input, which makes pin 6, U5b low (which in turn is fed back to pin 3 of U4). This low makes U4 change state; pin 15 of U4 goes low – stopping the clock. U4 (pin 14) then goes high, resetting the divide by 16 counter to zero.

TT Clock

While the clock pulses (U2, pin 1) are going to the divide by 16 U7 and U6a, it is also being fed to U4b, pin 6; here it is divided by 2 and the (pin 10) U4b not Q output is now 11 ms wide. This signal is used to clock data into the shift register U8, pin 1. When a TTY signal is received, inverter U1a sends a signal to U8, pin 9, where it sits until a clock pulse comes to shift it into the first register. It sits there, waiting as well as the new information on pin 9, which is also waiting to be clocked into the first register, with the information in the first, moving on to the second. This action continues until all seven bits of data are entered into the register. But I do not need all the seven bits; just the middle five contain printing

Mother board with stunt box board, top view.

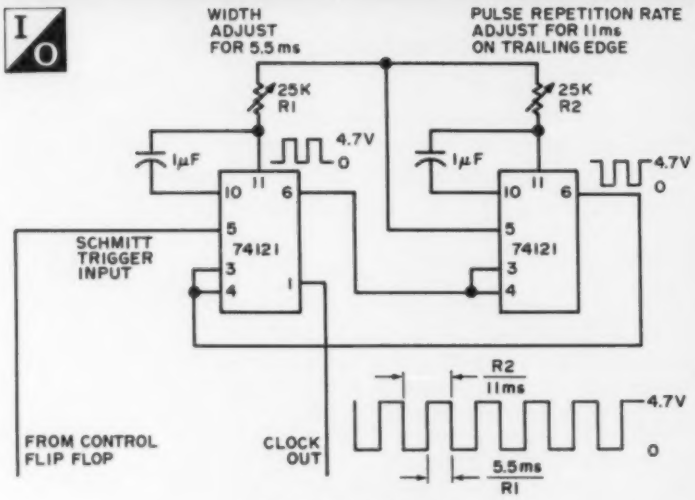


Fig. 5. One shot clock.

information, so at the time the first bit is shifted out of the register, the five needed bits of printing information are in the register. At this time the outputs are inspected and information contained in the register is passed to a four line to sixteen line decoder. By the way, the inspection takes place on the last part of count 12. (See TTL clock timing chart.)

Character Inspection and Decode

At count 12 gate U5a goes low, inverter U1b is high. This signal is fed to U6b input one as well as U6c. The output of U8 contains printing information in its 5 registers at this time, using only the four outputs to address a four line to sixteen line decode 74154. As this chip is addressed in binary, I can say that the output of U8 is a binary word msb (most significant bit) 01101 lsb (least significant bit). Forget for just a short time the msb 0. Let's look at 1101; this is binary number 13. When I check the truth table for a 74154 chip, I find a low on output 13 with all other outputs remaining high. If binary number 0001 were addressed to this chip, what output would be low? Correct, it is output

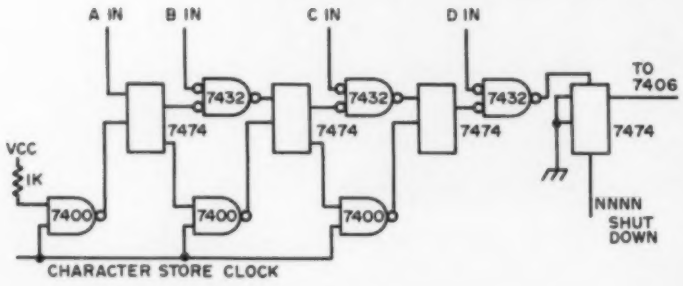


Fig. 6.

one. Now you can see how by taking a 4 bit binary signal and applying it to a four line to sixteen line decoder I will get only one low output for any binary number, input from 1 to 16. Serial baudot information is five bits long, so now take the 0 that I set aside a few moments ago and feed that 0 to a gate U6b and an inverter U1d, which in turn feeds second input U6c. A high and a low on U6b inputs will not allow U6b's output to go low; thus U9 pins 18 and 19 are inhibited, and all outputs from U9 will be high. But a low on inverter U1d gives a high out to U6c. A high on second input of U6c gives a low at its output, which enables U10, allowing output 13 to go low, where all other output pins remain high. Hence, I have decoded one out of thirty-two possible TTY combinations. One note U9 decodes all characters with the 5th TTY bit a mark, and U10 decodes ones with the 5th bit a space. The job is just about done now.

Sequence Character Recognition

As I decode only one combination of TTY binary at a time, I must store them so that a series of characters allows a turn on or turn off. This is done by feeding a selected character into a type D flip flop. If information is fed into the D input of the chip, it is passed on to the Q output at the time of the clock pulse; Q will stay in this state until the next clock pulse.

The Q output is now low (pin 5, U11a). When we place a second input low on U13a (taken from selected 74154 output), the output of U13a remains low. This low is fed to the D input pin 12, U11b. At the next clock pulse this low is transferred over to the Q output of this chip, and so on until the four selected inputs or turn on has been received. If a wrong character is received, the whole chain must be started again. For A in, B in, C in and D in must go low, each in turn for the correct turn on to be made. When the fourth character has been received, output pin 6, U13 goes low which sets U12b and makes Q pin 5 high. This high is fed to an open collector inverter which in turn goes to ground pulling in the motor control relay.

$\overline{\text{NNNN}}$ Shut Down

Because the N signal is low when selected from 5th bit space 74154, an inverter is used to get correct sense on data input to another 5 bit shift register U15. When four Ns are received in order, the output of the shift register is high. When fed to a four input NAND gate, output goes low (U16a). This signal is sent to the clear input of the relay control flip flop U12b making its Q output go low and the open collector inverter's output high, turning off the relay. A second four input gate U16b is set up to give an

output on $\overline{NNN}$; this second shut down is used for a stunt box control.

Stunt Box

I have used a new approach even here. The stunt box version is really just a second printed circuit board that is tacked on top of the CRD. On the stunt box board there are three new and separate character store flip flops. Each "channel" can be programmed completely apart from the others; hence decoded TAPE can turn on a tape perforator, CW ID could start an auto ID unit, etc. With any of the stunt box controls $\overline{NNN}$ shuts down all stunt relays but will leave the printer still going.

Power Supply

Power supply requirements are very low — 5 volts at about 500 mA regulated and 24 volts unregulated are just about all that need be said. An LM309 5 volt regulator is a good bet for the 5 volt line.

Station Integration

Operation and interfacing into a modern or not so modern RTTY station is best described as easy. Fig. 3 is a suggested hookup. The most desirable results will be found in the stations using one of Hoff's demodulators, ST6 TTL, TTL/2. These demodulators have an auto print section in them that turns on before the Selcal will receive any TTY data in. This makes for greater immunity to unwanted turn ons. One feature not talked about too much is signal regeneration. This is something that all amateur operators should make full use of, as our keyboards are often somewhat less than perfect. Signal regeneration is built into the CRD; by bringing a lead out from pin 15, U8, a correctly timed signal is available for transmission. As information is shifted through the shift register U8 by a local clock which is running at a pulse repetition rate of

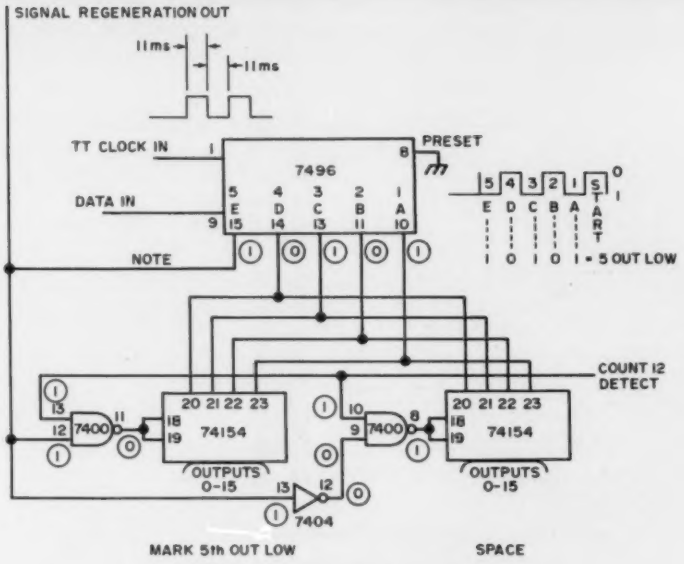
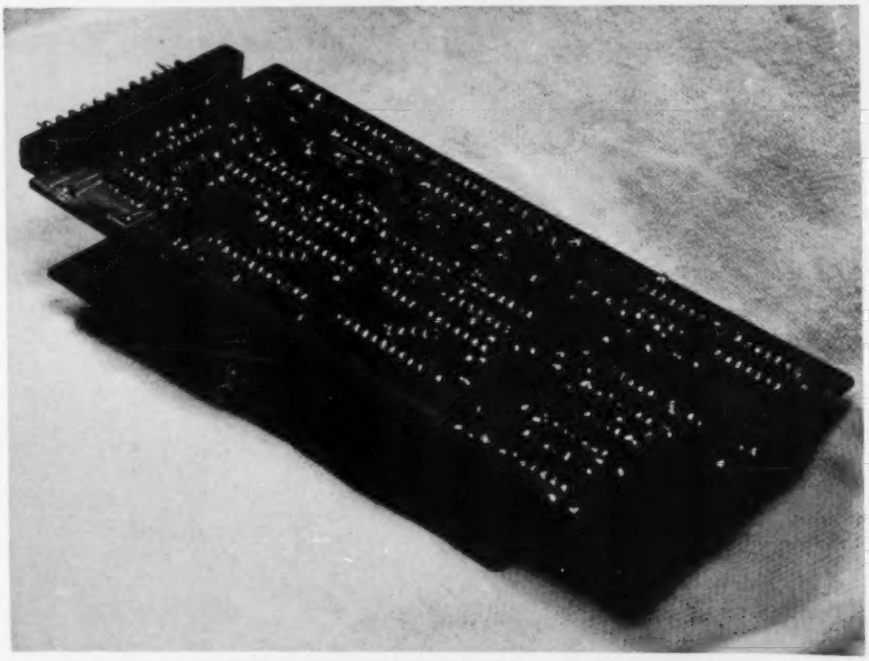


Fig. 7. Regenerative repeater.



Mother board with stunt box board, bottom view.

Operation and interfacing into a modern or not so modern RTTY station is best described as easy . . .

22 ms, a bias-free signal is present at this pin. The station hookup shows how to use this regenerated output to the best advantage.

Uses

This CRD could be teamed with a simple phase locked loop demodulator for a real good 2 meter repeater control system. First thing that crosses my mind is to turn heat on in the winter and off in the summer. You think of a few more.

Conclusion

Printed circuit boards and board layouts are available from the author for those who might need them.

The printed circuit boards that I have are about 3¼" x 7". This is the mother board; it has an edge connector on it for a 12 pin connector.

The stunt box board is just a bit smaller; its size is 3" x 6", and it fits nicely into an ST6 (Hal type); you just might remove the wide shift boards and place the CRD in there.

One thing that just might happen is, your call may contain two identical letters, e.g., 6AII. Normally you would decode letters A, I, I; however, you would find that your CRD would trip on the first I. This could be fixed by moving decode to Y or 6 letters A, I. This would give you a four character decode once again, but if others in your area have calls Y or 6, letters A, I (A through Z), your machine would trip off when that combination came along (most unwanted). So a change in clock signals is needed. One way, as yet untried, is shown in Fig. 6.

This circuit will clock the 7474 flip flops in sequence and should eliminate the problem of a turn on with I, I.

I would like at this time to thank Cal W9ZTK for an idea and the rest of the fellows that are on the WestCan Autostart frequency of 3632.50 MHz. ■

Parts Needed for the CRD

1.5k Ohms ½ Watt	1 only
470 Ohms ½ Watt	1 only
25k potentiometers	2 only
5 volt zener diode	1 only
74121 one shot	2 only
7404 inverter	1 only
7400 NAND gate (7437 used with stunt box)	1 only
7476 J-K flip flop	1 only
7496 5 bit shift register	2 only
74154 4 line to 16 line decode	2 only
7493 divide by 16	1 only
7420 4 input NAND gate	2 only
7474 D type flip flop	2 only
7432 OR gate	1 only
7406 open collector 30 volts inverter	1 only
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Mathematical Operations
*Debugging Tips
*Organizing Tables
*Maximizing Memory Utilization
*I/O Programming, Real-time Programming
*Programming for "PROMS"
*Search and Sort Routines
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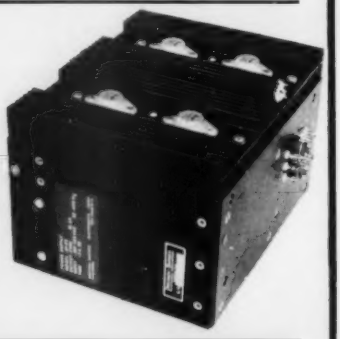

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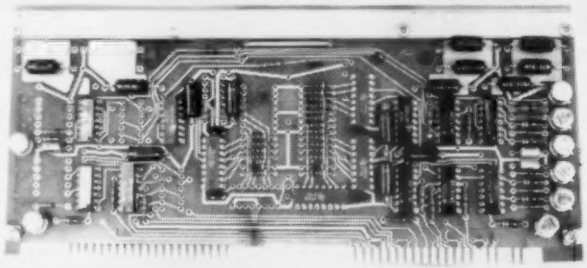

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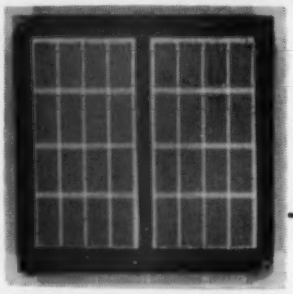

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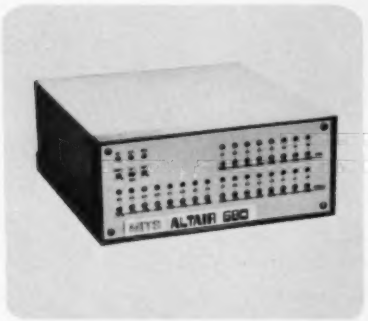

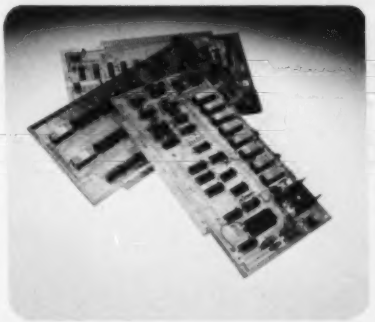

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Believe Me - I'm No Expert!

by
Wayne Green W2NSD/1
Peterborough NH 03458

Just in case any *73* readers are laboring under the impression that I know a whole lot about computers, minicomputers, or even microcomputers, let me put that delusion to rest. I know more about Arabian horses than I do microprocessors (uPs), and I am not a known expert on Arabians.

Before writing about microprocessors I wanted to clear the air and make sure that in this field, at least for the time being, I am a reporter, not an expert. Hell, I'm not even an advanced amateur yet, but give me time ... I'll get there.

After talking with the Sphere, MITS and Southwest Tech people during a hurried excursion out west, I got the distinct impression that, from the viewpoint of the user, the differences between the various microprocessors are mostly academic and that from an application view one will do pretty much what another will. Thus, whether you settle on a 6800 system, an 8080 system, a PACE, or whatever, most of your computer time will be spent waiting for the operator, not for the machinery.

Prototype of the Sphere 6800 system.

Until my visit to the manufacturers, I hadn't realized how very early we really are in the history of personal computers ... and particularly in microcomputers. Sphere had, in early August, one breadboard system running – but still with some glitches to be worked out. They had some program material worked out which they would then adapt to their system, eventually to be available in a 1K PROM.

MITS had their 8800 up and running, but the floppy disk system was still in development, and I gathered that the only bulk storage in use at the time was from cassette tape. Any computer system for business or for much game playing will need at least a floppy disk system.

Southwest Tech had a breadboard system going too, perhaps just a little bit further along than Sphere. I suspect that these systems have had a lot of help from Motorola.

The Sphere group is working diligently on many areas of development, with most of the work being done by a couple of the fellows. They were setting up their production facility, getting the glitches out of the prototype, getting the loader PROM ready, working on another PROM for BASIC, getting started on a floppy disk system complete with an assembler, editor and operating system called FDOS.

They also were working on a system which they claimed would be faster than a floppy, a quarter inch tape using eight tracks at 1600 bpi in a self-loading cartridge. One tape would have as much memory as 120 disks ... about 30 megabytes ... and the system would hopefully cost around $3000 including the controller and software. Next they had in mind a jig which would automate the plugging in of the cartridges. A set of five in one system would then permit 1500 megabytes of storage! That's

Mike Wise, President of Sphere, showing the complete microprocessor system.

1.5 gigabytes (pronounced jigabytes). This would run under $7000 for the basic system. It's exciting to think about. The maximum access time for a cartridge would be 20 seconds, which would put the average time at 10 seconds for random access.

Mike Wise at Sphere put me onto a firm that makes cassette drives which are ideal for computer use ... solenoid controlled ... and at a very reasonable price. A small system using a couple of these could be set up to run mailing lists and other indexed data. This would be great for the hobbyist who wants to make a little money on the side keeping small mailing lists ... club membership records, etc. Or

it would be fine for the hobbyist who would like to get into business in a small way selling relatively inexpensive computer systems for small businesses. I have a feeling that we will see a lot of program development for systems like this when the hardware is available.

I suspect that the whole field of programming is going to change significantly with the introduction of relatively low cost computer systems. Where before only large businesses could afford systems, now they will be everywhere and there will be thousands of people working up programs, not dozens.

Small systems will grow as rapidly as we are able to get them running with I/O devices and memory storage devices. *73* wants to hear all it can on these developments so they can be fed back to everyone in the field. Let's have user information on interconnecting the television typewriters to the Altair 8800, the Altair 680, the Sphere, the SWTPC 6800, the Godbout PACE, etc. Ditto Teletypewriters, used tape drives, used line printers, surplus keyboards, cassette recorders, floppy disk systems, etc.

There are some exciting developments coming along in mag tape systems which are a bit high for the hobbyist, yet are great for the small business ... let's be sure to write about these ... how to look them up ... operating systems, etc.

The idea of using a PROM systems software is a good one. I suspect that this will take hold. The Sphere idea of a PROM containing an executive, I/O driver, I/O for cassette, and I/O for a video terminal may take hold too. Sphere was talking about converting source language to machine language with a PROM, converting serial to parallel ditto, etc.

MITS

My talk with Ed Roberts, prexy of MITS, was most interesting. Rather than go it verbatim, I'll engistify it for you.

I asked Ed how MITS got into the microprocessor biz and this got him going in good shape. It seems that the term microcomputer was probably originated by the editor of EDN and the micro part of it has no relationship to the power, word size or the speed of the computer involved, just the large scale integration (LSI) of the IC involved.

Before getting into the 8080 based system, MITS looked over the market to see what was available. The IMP-16, a 16-bit machine, benchmarked a couple orders of magnitude slower than the 8-bit machines, so they decided not to go that route. Actually, according to Roberts, the 8080 is not an 8-bit machine, but a 24-bit variable word length machine that has an 8-bit arithmetic logic unit (ALU) and can directly address 65,000 bytes.

At the time of the decision to go 8080 there were only four other serious possibilities ... the 8008, the 4004, the IMP-8 and the IMP-16. Since the IMPs seemed very complicated and to need a lot of external hardware, it came down to the Intel chips. They almost went for the 8008, but the nod went to the 8080 after they added up the figures ... the 8080 is about 10 times as fast as the 8008 and only costs twice as much, leaving a 5X benefit. MITS spent about eight months evaluating the systems.

The M6800 came along later and seems to have some advantages for smaller systems – according to Roberts, the I/O structure of the 8080 is better for bigger systems. The PACE seemed to be slower than the 6800 or the 8080 and it is limited to seven or nine subroutines. MITS felt that a 16-bit machine would have a difficult time competing with a 24-bit machine. If the PACE had been significantly lower in cost, that might have been a factor.

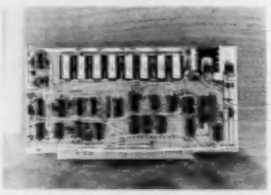
Whither Time Sharing?

Ed opined that time sharing is going to die. The data transfer rate is just too slow ... limited to about 30 characters per second (cps). And when you consider the cost of time sharing, with rates running from $5 to $7 per hour (MITS charges $2 per hour), you probably can buy a complete micro system cheaper than several months of that. Once ROM program chips are available you won't need any experts – when the power is turned on the ROM will provide the program to have the computer go to track zero on the floppy disk and load the operating program.

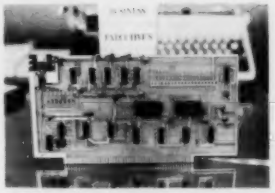
One problem is that as more microprocessor chips are developed this will result in the need for more hardware to be developed and, worse, more software. If the field settles in with the 6800 and the 8080 we may get a chance to develop a large number of sophisticated programs for use with these machines. If more and more microprocessor designs proliferate it could split the field so that much less is developed. The second sourcing of the 8080 by Texas Instrument and Advanced Micro Devices (third sourcing?), and the AMI second sourcing of the 6800, as well as the MOS Technology 6501, mean that these multisourced microprocessors will have a big head start over other uPs. The 8080 got a good lead by virtue of the head start of microprocessor innovator Intel.

MITS had no serious problem in deciding to

MITS 8080 CPU board.



Altair 4K dynamic memory board.



Altair serial I/O board for cassettes.

MITS work area with Altairs abuilding.

Production run of MITS keyboards.

accommodate the 6800 ... the Altair 680 backplane is exactly the same as the 8800 except for the CPU card ... and it plugs into the Altair bus.

The 6800 has two accumulators, an index register, and a stack pointer on the chip, but no general purpose registers. There is a short instruction format to access the first 256 bytes of

Wiring an Altair board.

memory conveniently as a general purpose scratch data area. With the 8080, there is one accumulator, a stack pointer and six registers which are paired for use as pointer registers. These are often used as if they were general purpose registers, which is handy since the 8080 cannot reference memory addresses directly for most instructions.

What major problems has MITS had? Delivery has been about the only problem, but it has been a big one. At the time they started making deliveries of the 8800 they had 24 people ... now they have 85 ... and it takes time to find and integrate new people into a company. No department can handle more than one or at the most two new people at a time and function well, so this severely limits the speed with which a firm can safely grow.

The Altair clicked none too soon. MITS had been heavily dedicated to the calculator field and joined all the others in taking a terrible bath when calculator prices dropped off the end of the dock. The firm lost about $200,000 in 1974 and things looked very bleak by the time the Altair was announced. It was a tremendous gamble for no one knew for sure whether there even was a market for a microcomputer ... particularly one in kit form. It turned out that there was indeed a market and well over 5000 8800s have been shipped so far ... about 60% of them kits, and about 50% to hobbyists and 50% to OEMS.

Ed had some glowing things to say about Altair BASIC. The Altair BASIC interpreter was developed jointly by MITS's software wizards Bill Gates, Paul Allen and Monte Davidoff – who are now busily working on an extended BASIC and other packages. (It turns out that most systems software packages such as Altair BASIC are designed by individuals and implemented by at most two or three people as was the case here.) The 8K Altair BASIC, claims Ed, outperforms just about any other BASIC going. A week spent with BASIC and you will be in shape to write some pretty good programs. The nicest thing about BASIC is that there are many programs in print in the innumerable books on this language.

I asked about the possibilities of hobbyists using some of the cast off computer peripherals which are around fairly reasonably from used computer firms. Ed blanched. If a big disk drive is inexpensive you can look for big troubles ... big expensive troubles ... then there is the matter of working up an operating system, a detail which could take an enormous amount of time. This might be practical for someone with a lot of experience and all the time in the world. The larger tape drives could back you into the same corner.

Stuff which is RS-232 oriented would be fine, such as line printers, Teletypes and video display units. The chances are that you won't be finding all that many VDTs on the bargain counters. Paper tape readers might be a good deal.

This brought us down to some discussion of larger memories ... the soon to be released MITS floppy disk system ... and some other memory storage schemes that are in the works. For instance, there is a new ¼" eight track tape cartridge that may be as fast as a floppy. It will search at 240 inches per second. It will also read and write at this speed, but the inter-record gaps are wasteful and they figure to read and write at 62½ ips since the read and write time is trivial to the search time ... you search by counting the gaps between records. One cartridge can hold 14 megabytes unformatted and about 8 megabytes formatted.

Games

The discussion got around to computer games and Ed mentioned the lunar landing game wherein you have to try to land on the moon with zero downward speed ... it took him the best part of a night to get the hang of the very non-linear problem involved. Star Trek is another game which fascinates just about everyone who gets involved with it ... it is quite sophisticated and intricate. I asked about chess ... he said he would try to get a copy of the Data General chess game ... supposed to be the second best computer chess program available ... but not much of a challenge for any serious intermediate or higher level chess player.

In all it was a most interesting visit ... I learned a lot ... and let there be no mistake that I still have a great deal to learn before I will know enough to even read the computer literature and understand it. I would like to let any readers who might be feeling a bit edgy about the more technically oriented articles in *73* know that in time you and I will understand what is going on ... we may even be able to talk computers with both hardware and software pros.

SWT

The third stop on my microprocessor tour was Southwest Technical Products in San Antonio. Actually this was just a very lucky coincidence, for I went there to see them in regard to their television typewriter unit which is a natural to go with computer systems as well as amateur teletype.

Dan Meyer, the president, and Gary Kay, the chief engineer, spent the day showing me their new

Dan Meyer, President of Southwest Technical Products Company.

6800-based microcomputer system which is due to be released soon in kit form. They had a prototype system set up and working and it certainly was impressive. I asked a lot of questions, trying not to make my abysmal ignorance of microprocessors too evident.

For instance, I asked how come they went with the 6800 chip for their system instead of the several others available.

8080 vs 6800

While I figure it will be quite a while before the proponents of each chip will be cool enough to sit down and work out a comparative evaluation of the situation, this has not stopped me from asking the participants to give me their reasons for going one route or the other.

Gary Kay, the computer engineering brains at Southwest Tech, tried to explain the differences between the two chips to me and why he decided to go with the Motorola 6800. I understood things here and there, aware of a need for a better interface for dealing with people who speak in computerese.

Well, it seems that Gary looked into everything available ... went to courses provided by the chip manufacturers ... read a lot ... and it all came down to the 6800 for him. It was much easier to interface than the 8080 ... required fewer external parts since much of the work is done by software instead of hardware. This need for fewer parts would seem to be demonstrated by the substantially lower cost of 6800 based units vs. 8080 units (the MITS 6800 based unit is $293 vs. $439 for the 8080 kit).

With the 6800 you can set up any of the 16 lines for input or output and change anytime you want just by programming instructions ... even in the middle of a program. You can program the system to give any priority for a particular input device. You can do a lot of things with programming that have to be done by switching with the 8080. You can even program whether it will work on a positive or negative strobe (if you are). The handshake line ... lets it be known when data has been received ... is all right there on the chip. The 6800 was designed as a system and thus takes less outside equipment to get it working.

Another plus is the Motorola supplied MIKBUG, a small operating system which is available on a ROM chip. This is a nice feature which can be appreciated by 8080 users who find they have to start out by hand switching in about twenty steps before the system will be able to accept programming from tape or cassettes ... or even a keyboard. Thus, with the 6800 systems you can just flick on the power switch and the initial programming is all done by the built-in read only memory and you find a snowflake blinking at you on your screen indicating the system is ready for use.

This elimination for the necessity of hand switching in the loading program has made it possible to do away with the usual computer front panel and its row of switches and rows of LEDs. Further instructions to the system can be put in by means of a keyboard using octal or hexadecimal notation, whichever has been programmed in by the ROM ... hexadecimal in the case of MIKBUG.

As time passes we will see whether the 8080 or the 6800 systems have more for the users ... and that is the bottom line.

The Southwest Tech 6800 kit sells for $450 and includes some handy items. There is

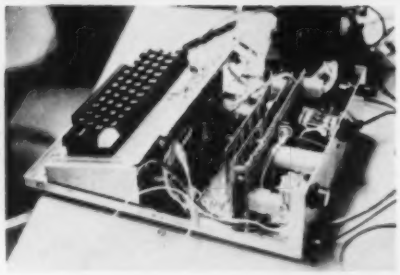
Sumptuous SWTPC front office.

Silk screening front panels for SWTPC kits.

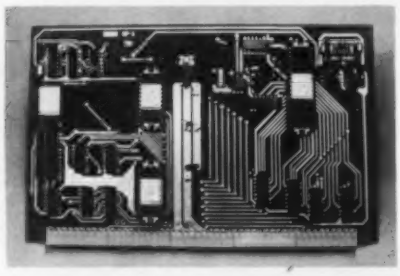
Kit assembly area at SWT.

Parts picking for SWT hi-fi kits.

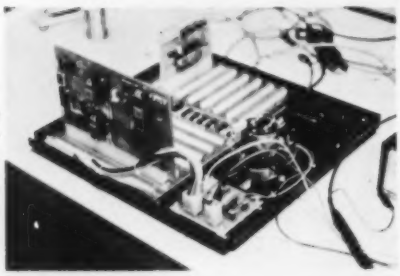
Service area — when the kit builder needs help.



SWT television typewriter ... being used an an I/O for their new computer kit.



M6800 CPU board, part of the SWT kit.



Prototype of the SWT 6800 computer kit.

Gary Kay, the chief engineer of the computer project.

the mother board into which the processor, memory and I/O boards plug, a chassis and cover, power supply, the processor board with the 6800 chip, ROM MIKBUG, 128 bytes of RAM and a clock for the system, and a board with a serial input/output for teletype or RS-232 such as the CT-1204 terminal. A 4K memory board is also included which has 2K on it and space for plugging in 2K more to fill out the 4K ... the extra 2K is available for only $45. The result is that you have a complete computer system for $450.

In addition to the 6800 kit you'll need to have some sort of I/O device, probably either a teletype with ASCII output or a TV video system such as the CT-1024 kit and a TV set. You'll need more memory for any practical computer operating system ... certainly the extra 2K and more probably a total of 8K. You will need some sort of bulk memory system such as a cassette recorder and an I/O board which will interface it to the system. Floppy disk systems are nice, but they are still too expensive for most hobby systems and the programs to operate them have yet to be written.

The Southwest Technical operation is a beauty to behold. They are using a Datapoint computer system to run the whole works. The sales are 100% mail order and each order is entered in the computer as it is received. A label and packing slip is printed out for each order and an acknowledgement sent out automatically. Each week all orders are processed by the system and inventory records updated to account for every resistor and part used in the kits. Delivery schedules are in the system too, so when parts in stock get below a quantity which might cause them to run out the computer initiates an order for the parts. Since this system was set up there have been no delays in filling orders due to out of stock parts!

Questions on orders can be quickly resolved by searching the computer memory for the name, zip, or even the ordered kit. Everything is right there at hand.

Dan Meyer, the president of Southwest Tech, took me for a tour of the plant ... it was enormous. The printing department is bigger than the *73* printery which turns out the many *73* books ... acres of space filled with shelves of parts, people putting kits together, and more cartons that you would believe. The company has built up a good name in the hi-fi field where it is one of the largest of the kit manufacturers and known for the high quality of their units.

The first excursion into ham territory was with their television typewriter kit ... a natural for RTTY operators. The CT-1024 terminal system, first made known in a nice article in *Popular Electronics*, consisted of a character generator, sync and timing circuits, cursor, 1024 byte memory ... all you need to put a 16 line message on the screen of a television set with a video jack on it. The 1024 byte memory is enough for two pages on the screen and the unit automatically switches from one page to the next when the bottom of a page is reached. This kit sells for $175 and is very simple to put together. My twelve year old daughter helped with a good deal of the assembly and soldering of my kit.

A power supply for the unit is available for $15.50 more, as is a keyboard for about $40 and an output interface to feed ASCII to your RTTY system or to a computer ($40). Thus, for about $275 you have a complete system, requiring only an old black and white TV set for a display and an RTTY system geared to ASCII input (RS-232). Compared to today's teletype machine prices, that has to be one of the best bargains going. Compared to commercial video display keyboards it also was an outstanding buy.

The SWTPC 6800 computer kit looks like a winner, too. Priced at $450, it includes a 714 page applications manual, the 6800 chip, the MIKBUG ROM operating system, a serial interface which will operate a 20 mA teletype or work with their TV typewriter system. ■

the story of: SON OF A CHEAP CLOCK

(*SYNOPSIS:* REO PRATT, manager of Bill Godbout Electronics, sits at his desk...head in his hands. A worried frown crosses his face as he talks softly to himself.)

REO: What to do! Out of "Cheap Clock" kits, with orders still coming in...Blast! if only Bill were here.

(Bill walks in)

BILL: Hello, Reo, what's up?

REO: We're out of "Cheap Clock" kits...orders are coming in and we'll have to backorder some!

BILL: Then it's time for a *NEW CLOCK KIT*...I know! We'll call it *SON OF A CHEAP CLOCK!* It will have bigger digits---how does 3/10" sound? And brighter, too...we'll have both segment and driver transistors. We'll give 'em sockets for the IC and readouts...no case, though, we'll let them choose their own.

REO: Hey---let's give them data on how to use the clock in their car with our 60 Hz Time Base Kit...we'll probably sell more of those, too!

BILL: Sure, we'll put lots of info in the data: how to cut the board and remote the readouts, how hams can make it run on 24 hour display & how to run it on 50 Hz. As far as the cost...let's see, the parts come out to about $9.50.

REO: $9.50---That's cheaper than anybody else's price!

BILL: But--wait a minute...I think people would rather have all the parts necessary to build a working clock. We can throw in a transformer for 2 bucks and a circuit board for another 3---that's only $14.50 altogether.

REO: $14.50! That's really something. Better have them add 1 lb. for shipping, too; you know how transformers are.

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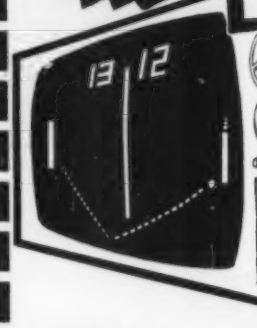

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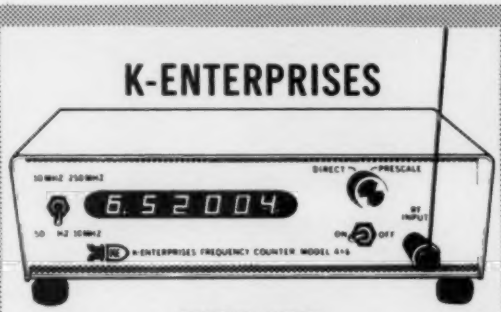

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Night DXing on 10 and 15

Talk about a rat race. If the 40 and 80 meter bands aren't a rat race after 9 PM, then what is? If you're like me, tired of foreign AM broadcasts on 40, or 80 with its 50 kHz of pileups, read on. The closest comparison to 80 at night is a Martian ham station calling CQ DX on 20 on a Saturday morning, only more so.

Getting back to 10 and 15 night DXing: It isn't really DX, but it has all of its rewards. It sounds like DX, is just as thrilling (for me anyway) and boy it's a big band or two and nice and quiet. Talk about QRM free, here it is.

Working a fellow novice, or anyone who happens to be "slumming" on 10 or 15 at night is just great. There's the QSB of DX as the ground waves fades. There's that low lonely signal to pull out of the mud; who cares if he's only 50 miles away? It's just as hard, if not harder than any DX you ever work. And I mean pulling him out of the mud, for he's as subterranean as you can get. But that's where the thrills come in. The accomplishment of the above feat is equal to working any DX. He sounds like he's in Asia, so who cares if he's fifty miles away?

I've been a Novice for about nine months now, and have worked my share of DX. For the most part, when it's in, it's in, but when it's out, forget it. There's rarely any sweat working G's, I's, ON's, etc. when they're 469 or so. Compare these sigs to the guy 229 fifty miles away and you're getting the idea.

Living within Metropolitan New York City, I'm sure that more than a few hams can CQ on 10 or 15 at 10 PM nightly. Just think, a total of 200 kHz of quiet to work with.

I guess for the most part a great many Novices tune 10 and 15 for a few minutes at night, they hear nothing, and go to war on 80. However, I'm almost certain that if a bunch of Novices start calling CQ on that virtually dead band, something will start.

By the way, I've listened to 15 meters from 9-11 PM EST at times, and lo and behold out of nowhere, on a seemingly dead band, "CQ CQ CQ DE ZL1A ..." So, my fellow hams, if you've got those PM blues like me, let's get with it. Anyone within 100 miles of my QTH drop me a line and we'll try and sked. All you others try some 10 and 15 meter Nocturnal DX. You'll be just as excited as when working a real one. If not, there's always girls.■

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	14	7B	7B	7	7	7	14	14	14	14	14A	14A
AUSTRALIA	14	7B	7B	7B	7B	7	3A	7	7A	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	14A	21	14	14
ENGLAND	7	3	3	3	7	7	7	14	14	14	7A	7
HAWAII	14	7B	7	7	7	7	3A	3A	7B	14	14A	14A
INDIA	7	7	7B	3B	3B	3B	7B	14	7A	7B	7B	7
JAPAN	14	7B	7B	3B	3B	3	3	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14A	14	14
PHILIPPINES	14	7B	7B	3B	3B	3B	3A	7	7	7B	7B	7B
PUERTO RICO	7	7	7	7	3	3	7A	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7B	7B	14	14A	21	21	14	14
U. S. S. R.	7	7	3	3	7	7	7B	14	14	7B	7B	7
WEST COAST	14	7	7	7	7	7	7	7A	14	14	14A	14

CENTRAL UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3	7	14	14	14
ARGENTINA	14	7B	7B	7	7	7	7	14	14	14	14A	14A
AUSTRALIA	21	14	7B	7B	7B	7	7	7	7	7A	14	14
CANAL ZONE	14	7	7	7	7	7	7	7	14	14A	21	14A	14
ENGLAND	7	3	3	3	3	3A	3	7	7A	14	14	7B	7B
HAWAII	21	14	7	7	7	7	7	7	3A	7	14	14A	21
INDIA	7	7	7B	3B	3B	3B	3B	7A	7A	7	7B	7B
JAPAN	14	7A	7B	3B	3	3	3	3	3	7	7B	7B	14
MEXICO	14	7	7	3	3A	3	3	7	14	14	14	14
PHILIPPINES	14	14	7B	3B	3B	3B	3	3	7	7	7B	7B
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14A	14A	14	14
U. S. S. R.	7	3	3	3	3	3	3B	14	14	7B	7B	7

WESTERN UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	14A	14	7B	7B	7	7	3B	7B	14	14	14A	14A
AUSTRALIA	21	21	14	7B	7	7	7	3B	7	7A	14	14
CANAL ZONE	14	14	7	7	7	7	7	7	14	21	14A	14
ENGLAND	7	3	3	3	3	3	3	7	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	3A	7	14	21	21
INDIA	7B	14	7B	3B	3B	3B	3B	3A	7	7	7	7
JAPAN	14	14	7B	7B	3	3	3	3	7	7	7B	14
MEXICO	14	7A	7	7	7	3	3	7	14	14	14A	14
PHILIPPINES	14A	14	7A	7B	3B	7B	7B	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14A	14
SOUTH AFRICA	7A	7	7	7	7B	7B	3B	7B	14A	14A	14	14
U. S. S. R.	7	3	3	3	3	3	3	7A	7A	7	7B	7B
EAST COAST	14	7	7	7	7	7	7	7A	14	14	14A	14

Open = Good ○ = Poor □ = Fair

1976		FEBRUARY				1976
SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29			FIRST QUARTER	FULL MOON	LAST QUARTER	NEW MOON

A = Next higher frequency may be useful also. B = Difficult circuit this period.

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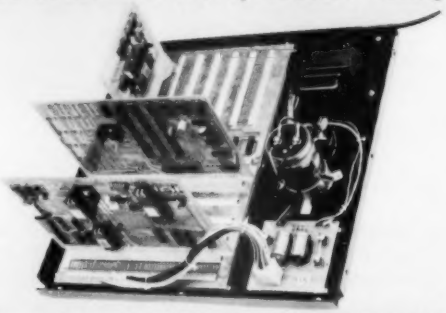

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7	8	9
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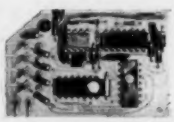

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60 Hurts Per Second

I sometimes wonder about the history of hams — everybody knows that amateurs have been responsible for technical advances in radio. But I can't put this into perspective when I think of my own work. Like the first project I ever built. It was a 30-watt peanut whistle from the Handbook. I thought I was doing something just barely removed from basic research — at least until I got to the parts supply house.

The guy behind the counter had the gall to tell me that the 5U4 could be replaced by this new tube — it was a 5AR4 — and it was smaller, more efficient, and cheaper, too! So I dropped my self-esteem a tiny bit and took it home to start work. My high school radio club advisor suggested I scrap it for a few silicon diodes. Well, he was a physics teacher, and everybody knows that they know all about these modern techniques. I used the tube — but I started to play with them "solid state" devices that were suddenly everywhere in radio.

I was pretty sure of how to use silicon and the old-fashioned seleniums when I took that junior college course called "Tubes and Transistors 109." I signed up thinking that we would be used as consultants to the guys at RCA when they needed some help. But that course ... I showed up for lectures that sounded more like a karate demonstration in a Greek restaurant. Imagine walking into a room and hearing "Hfe Hie Beta Fco Alpha." What the heck was he talking about?

I got through the course. I can't say that I got an A, but I was finally up on the latest. So there I was — I knew the latest terminology from the industry and could do real up-to-date work. So who asked for help from ARRL-FCC? Why couldn't they leave well enough alone? HERTZ, indeed! No offence, Heinrich, but I still say cycles per second. At least until I get my fingers across the a.c. line, at which time I get 60 hurts per second.

So our hero (that's me, ace wizard-experimenter-researcher) strives to help the world move ahead by applying this wonderful knowledge of up-to-date electronics. I was thinking of something along the line of miniaturization. I stopped at the familiar

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HAM DIES OF BURST BLADDER!

Word has just reached the 73 offices of the recent departure for that great DXpedition in the sky of a very avid 73 reader. Upon investigation it was ascertained that said ex-ham had, shortly before his demise, received delivery of a bundle of back issues of 73. Apparently these so captured his attention that other functions were totally forgotten.

BE WARNED. Back issues of 73 should be taken in moderation. Even though they arrive in bundles of twenty, no more than two should be read at any one sitting.

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parts house to get some reference works ... and saw books about the new integrated circuits. One fellow must have thought like me, though. His electronic device was dubbed the ICKEY. My feeling, exactly.

I was not stopped by the move to "small," though. Even though my head was turned by stone-crushers running 3-phase 208 through the primaries more than it was by those tiny transceivers Al Kahn was making, I thought about trying QRP. I did, and it worked fairly well. I used a borrowed HW-7 and made one contact on 40. He was about 4 miles away, and still insists that he did hear me that day. We used 2m FM for liaison. The antenna, of course, wasn't the best — hookup wire wrapped around the copper heating pipe for about twenty feet before it led outside where it paralleled the gutter. But I had heard that these little rigs didn't need much of an antenna, and anyway, I was using a transmatch. I could set the thing, though, since my SWR bridge would work with that ridiculously small amount of power, but I did arrange the taps so that they looked pretty, and that should have been enough...

QRP having proved nothing, I went back to my plans for giving RF burns to all within miles of the main lobe. I went through my usual process of modernization, going from the old glass 4-400A to a couple of 4X150's to the ceramic 4CX250A to the ultimate — a 4CX1000A with only about 15,000 hours on it. The engineer from the local FM station said it had been taken out of service as regular maintenance — not for any defects in operation, although it wasn't quite as perky as when it was new. After scraping the corrosion and smoke from the tube I settled down to build. I even secured that one thing that *NO* high-power rig can go without — a forty horsepower wind generator from Hollywood. I figured that would provide my state of the art amplifier with sufficient cooling air to take care of all possible eventualities.

Apologies for the little break, but I just got the mail, and I took a break to read the ham magazine that came. I see a high-power amplifier is shown inside. That just might be what I needed — a chance to compare notes with the author, and maybe give him a hand with design modification. Funny looking circuit, though. I don't see the fan to cool the final. Hey! What's CONDUCTION COOLING? ■

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Catch Big Ones - Fishpole Mobile

by
Joe Rice W4RHZ
916 Western Ave
Covington KY 41011

After investigating the available "store-bought" mobile antennas and looking at their prices, I came away more than chagrined. Not only were the prices high, but equally important the swr was poor, indicating a sort of compromise in design.

I decided to build my own. Having already done reasonable experimenting on other bands, I decided I would like to try mobile CW on 20. On lower bands, such as 80 and 40 and even on 160, the efficiency of mobile antennas falls off sharply. 80 meters still had an appeal for me but I decided 20 was better because of the skip conditions. Incidentally the whole rig was built using an old 1625 tube driven by two type 6F6s as buffer and driver. The vfo was home built using three transistors operating on 40 meters and mounted in the front of the car.

As no one has really resolved whether center loading or base loading is the best, I decided to use a little of both. The general philosophy was to make the center loading less than optimum and augment this with the correct amount of inductance in the base to bring the system into resonance.

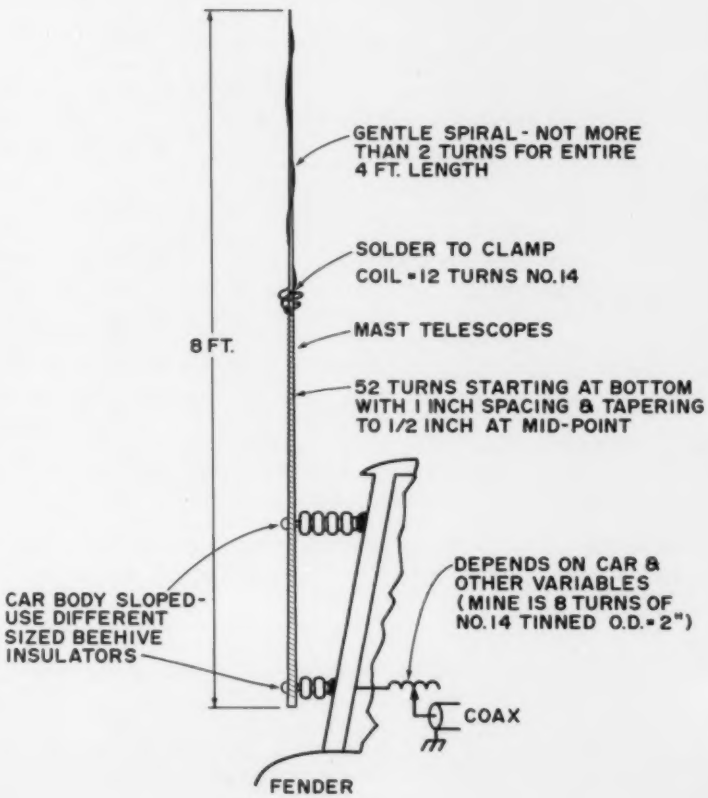
Bamboo is hard to obtain these days, for some reason, but I did find a three-section fishing pole at the nearest hardware store which was small in diameter and had a lot of give to it. I decided to use the old-fashioned beehive standoff insulators to hold the antenna away from the car body. I had some compunction in using the ceramic as I first thought it was far too fragile for mobile use. It has proven to be very durable. I even whacked a few tree limbs on purpose at a reasonable speed of 30 mph with no ill effects.

The fishing pole comes in three sections, each fitted with a brass fitting so as to telescope into the mating section. I only used two sections making an overall height of 8 feet. To obtain greater efficiency, I wrapped number 16 wire around the bottom section to get the inductance up. The center coil was mounted on two aluminum clamps bolted around the bamboo. I used a soldering lug in order to solder the coil directly to the pole. The top section of bamboo has another piece of number 16 stretched to the top with just a gentle curl around the pole. This is done so that the wire will not break if you should hit a tree limb. If the wire was stretched out straight, it would bend in such a manner as to break.

When I first grid-dipped the whole affair it dipped in the 27 MHz band! It would seem that the grid dip meter only sees the overall height of the antenna, sans any coil at all. Another dip was found nearer the 14 MHz region.

The insulators were mounted using self-tapping steel screws and a piece of cork gasket material between the car body and the insulator to take up the shock. I put varnish around the whole thing later to keep moisture out.

The photo and diagram tell the whole tale. What is not shown is the feed system. I tried every system in the mobile handbook to no avail. In desperation I used a piece of coax cut to the right length so as to look like a quarter-wave transformer. Like most amateur radio operators I do not have the facilities to measure the radiation resistance presented at the base of an antenna. An educated guess told me it was in the general neighborhood of about 20 Ohms. Using a piece of RG 58U cut to a length of 10½ feet, it yielded an swr of about 2:1. Anyway, it works! Since the center loading coil is mounted on the top section, I can easily change it to operate on each band. The entire 12 foot, 3-section pole only costs $1.39 and is apparently tougher than any man-made material. ■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MAST TELESCOPES
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Glitchgate

by
George M. Ewing WA8WTE
510 Sheridan Drive
Sault Ste. Marie MI 49783

We had been out at John Gregory's house for several hours, working on an old Russian samovar that his mother had brought back from the Turkish highlands near Adana while on a DXpedition in the Middle East. We couldn't seem to keep the charcoal lighted and were thinking of forgetting the tea and using the silver hot water tank for a coaxial tank filter for the backup receiver on VE3SSM. Suddenly we realized that it was after eleven, and that there was no beer in the house. It was definitely time for a break anyway, so John and I fired up Supertruck and trundled on down to the Antlers Bar & Grill.

When we got there, our usual seat under the Chippewa war canoe had been taken by some boisterous hockey fans, so we settled for a corner table between the stuffed boa constrictor with the snowmobile helmet and the Eire flag. The snake is a regular patron of the Antlers, and on St. Patrick's Day has been known to slither down the bar and drink green beer from the customers' glasses if they aren't too alert to snatch them away.

At any rate, after John and I had ordered our Paul Bunyan Burgers and drafts, we resumed a previous discussion, something about Middle East Politics and Long Delay Echoes. Some of the people from Harvey's basement came in, swiped some chairs from the table on the left of the stuffed moose's ass, and joined the group. This perforce changed the thrust of the discussion to such technical niceties as the superiority of non-volatile ferroelectric memories over ECL and the advantages of sapphire as a substrate material.

He was tracking the thing so intently that he forgot his instruments and found himself in a screaming Kamikaze dive . . .

Frank Ostrander and some of his FAA buddies came in, and took the other adjacent table, under the steam whistles. Frank's a ham, but he's not into semiconductors much, so the conversation gradually shifted to weather and flying stories.

John Gregory started us off by telling the one about Dick White, a VHF nut and pilot who had been stationed at Kincheloe Air Force Base. Dick had been flying a mission out over Lake Superior one spring evening when he got a U.F.O. from the boys at the 753rd AC&W radar station, and was ordered to investigate. When he arrived at the target area, he reported that he saw a 213m (700') long spaceship with rows of lights along its sides. He was tracking the thing so intently that he forgot his instruments, followed the image through a temperature inversion, and found himself in a screaming Kamikaze dive at the Wilfred Sykes, a lake freighter on Whitefish Bay. He pulled out in time, and after an embarrassing hour's debriefing, went home, fired up the 432 rig, and got three more states and Manitoba before the opening died.

Bill Rennamaki and Mike Daniels came in about then and joined the group. They swiped two more chairs from over by the Fokker Triplane propeller with a stuffed dog on it, and ordered another round. Mike's a radio astronomer for NASA out at North Liberty IA, and told several solar flare and LDE jokes.

John Michael retaliated with another U.F.O. story, this time about one that WE launched. This particular one had been 30m (100') plastic film hot air balloon supported by a peanut butter pail full of burning gasoline. It had been a real beauty, with tuned radar reflectors, strobe lights, and a scrounge TACAN transponder on it to confuse the Air Force. John Michael had burned his fingers lighting the gas, and henceforth claimed that he was one of the few verifiable U.F.O. casualties.

After a few more flying stories and a halfway serious proposal for a high altitude balloon repeater for emergency coverage during disaster that was shouted down, at least for the U.S. side of the river because of licensing problems, we saw an old friend come in: Frankie Leitenen, the tool and parts king of the Northern Michigan hamfest flea markets. Frankie had started to take a

Drawing by Neal Kandel

table 'way in the back, under the nude autographed portrait of the 1948 Detroit Red Wings in Toivo Crimin's Sauna Bath. We hollered and motioned, and finally he sauntered over, dictating his hamburg order over his shoulder to the waitress.

Everybody was glad to see Frankie. He hadn't been around the Antlers for a couple of years, or at a hamfest for longer than that. We'd missed him, too. He'd always had the best deals on tools, tubes and small components at all the swapshops. I'd bought stuff from him from time to time: an obsolete tube, a roll of Teflon tape, or a handful of ICs that I needed for the latest project. You just couldn't beat his prices, and at least at first, he had always been willing to take your junk in trade, even some pretty unlikely stuff. We had always wondered where he'd gotten all that junk, and when he sort of disappeared, there had been a good deal of speculation that he'd gotten in trouble with the military for scrounging too handily at surplus disposal depots, or been the subject of an IRS witch hunt.

He seemed cheerful enough now, though, and if he'd had a run in with the Mafia or Uncle Sam it hadn't left any outward scars. He did seem to be looking over his shoulder a lot, though. As soon as Trixie, the waitress, had brought his Paul Bunyan and tied the bib with the shamrocks on it around his neck, he was bombarded with questions. He was non-committal at first, but then the question was put more bluntly:

"Why the hell aren't you at the swap-and-shops any more, Frankie, you been in jail or something?"

He made the old familiar empty pockets gesture, from the horse-trading days, and said something to the effect that he'd love to buy a couple of pitchers of beer for the gang and tell us all about it, but that he had payments to make on his new triggered-sweep scope. Also, he was low on beer money and, anyway, we'd scoff and wouldn't believe him.

Well, this was a pretty obvious come-on, but I reckoned that a good story was worth the price of a couple of 807s. Several others agreed. A small but impressive pile of bills and change appeared on the table, and we were giving Trixie our orders when some fool hockey fan down by the Samurai swords ordered a steak.

Perhaps I'd better insert a parenthetical note at this point. All the gongs, whistles, bagpipes, air raid sirens and other junk on the walls of the Antlers are functional, and *loud* to boot. When a steak order comes in from the teletype terminal by the meat case, two or three demented bartenders run up and down the bar, pushing buttons, stomping pedals and swinging bung-starters. All hell breaks loose.

When one of my buddies was back in the world from Tay Ninh a couple of years ago, he heard the steak siren for the first time in over a year. He dropped his beer on the floor, made a running dive hollering "INCOMING!" at the top of his lungs, and slithered around under the tables, looking for a bunker.

After the brouhaha had died down, and the steam from the whistles had cleared out so that you could see, Frankie continued as if nothing had happened.

"As I was saying, it all began soon after I bought that old yellow farmhouse out on the Pickford Road. The old couple that lived there thought that the place was haunted, or something, and I got it at a really bargain price. I tried to get some information from them before they piled into their camper and scrammed for Florida, but all I got was a few incoherent mutterings from the wife about 'varmits' and 'toady-frogs.' I moved

in the same day, set the workbench up and strung up some antennas."

There was an interruption for a couple of minutes. Somebody at the next table had left a silver dollar as a tip for Trixie and it had disappeared before he had even left the table. He stalked angrily around the room, peering under tables and chairs. His buddy tried to console him, telling him that it wasn't really silver anyway, only an Eisenhower slug. But he was still angry when he finally walked out.

Mike interrupted, asking what the glitches were supposed to look like. I told him they were long-nosed, pointy-eared creatures . . .

Frankie continued, "I spent the next few days sorting my junk, which didn't really amount to a lot in those days. I kept my eyes peeled for the varmits the old lady had mentioned, but without success. I did glimpse something scurrying around out of the corner of my eye a couple of times.

"After a while though, things started to disappear: small tools, hardware, transistors, that sort of thing. At first, I thought I was just being careless, but one night an expensive UHF power transistor vanished from the middle of a perfectly clean bench. I spent about an hour going over the floor, table, the works with a Tensor lamp and a magnifying glass – nothing.

"I took a few minutes break, and got a Coke out of the cooler upstairs. When I returned, the transistor was still gone, but there were several lockwashers and an unmarked TO-5 case with six leads lying on the same spot on the bench."

"Packrats," said somebody at the next table.

"No, gentlemen," said Frank. "I had been convinced that I was dealing with glitches."

Well, this got a good laugh, and several members of the group, taking this to be the punch line of Frankie's story, started to tell about *their* adventures with the glitches. Frankie was far from finished, however, and he tore into the scoffers with an almost missionary zeal. I was skeptical, of course, but not so much as you might think. I had mislaid tools and parts over the years, sometimes returning to find them in plain sight, sometimes not. Then there was the scissors hole at Gregory's house. Over the years, dozens of scissors, tinsnips and wire cutters had disappeared. Only a few of them had turned up, and those had been badly corroded.

Frankie went on, describing the battle he had reeling in the recalcitrant little beastie, as big a fish story as any steelhead angler ever told . . .

Mike interrupted, asking what the glitches were supposed to look like. I told him that they were undoubtedly descendants of the original World War 2 gremlins, and were, therefore, long-nosed, pointy-eared creatures, like the AMC emblem or a cartoon Martian.

Frankie was downright contemptuous. He said that showed how much we knew about glitches, namely zilch. Ostrander, scribbling notes on his placemat, motioned Trixie to bring a couple more pitchers. An Air Force colonel had come in and was listening to the proceedings with a bemused grin. Two strangers with overcoats had followed him in. They were sipping beer under a picture of John Philip Sousa directing the 1924 Sault High School Marching Band.

Frankie continued. "You guys can laugh all you want, but I've seen them, and I have proof that they exist. Once I realized what I was up against, it was only a matter of time before I had a real, tangible glitch. The first thing I did was set up a Polaroid camera and a photocell focused on the spot on the bench. I left some shiny hardware and a handful of 2N706s on the table as bait. Over the next few days, I used up several packs of film, but with disappointing results; they were too fast. Even with 2000 speed film and a one millisecond flash, the pictures were blurry, but there was definitely something there."

Frankie went on, ignoring the hooh-hahs and jeers arising from the last. "I got a few pictures, showing a long, lizard-shaped thing, but nothing that would serve as proof. I lulled their sense of security for a while, feeding them copious amounts of hardware and shorted diodes and zip-tops. Once in a while I'd get something in return. After a while, they hardly paid any attention to me. I discovered that they weren't running across the bench, as I had first imagined, but rather were materializing and vanishing again, all within a meter or so of the center of the workbench. They were completely silent, never making a bang of displaced air, or any of the funny noises that are supposed to accompany poltergeists or supernatural creatures. Finally, I decided to set a trap for them.

"I took a particularly shiny IC case and put a few drops of Eastman 910 on it and bonded on the eyelet from a fishhook. I got a fancy spinning reel, and wound about 91m (100 yards) of Corbollon macromolecule filament, with hundreds of pounds of tensile strength, and nearly invisible. I bonded some scraps of ruby rod from a busted laser onto the reel bail as bearings. Then I hooked up an alarm, sat back and waited.

"I didn't have to wait very long before the alarm rang. The IC vanished, trailing line from a screaming reel. I half expected the line to be bitten off, or to be cut by the edge of the hole, or gate, or discontinuity, or whatever, but it wasn't. I had caught myself a real live glitch; now all I had to do was reel him in."

The colonel had pulled his chair up as close as he could. I recognized him now, an operations officer from Kincheloe. He was

listening intently, every bit as hooked as Frankie's glitch. The Overcoat Boys were squinting their ears so hard they were nearly falling out of their chairs.

Frankie went on, describing the battle he had reeling in the recalcitrant little beastie, as big a fish story as any steelhead angler ever told.

"I finally had him back through the gate and held him down on the bench top. He (I discovered later that he was an adult male) flopped and wiggled a bit, and then calmed down. Pretty soon I could hold him in my hands. He was about 32.8cm (1') long, shaped like a Gila monster or salamander, and surprisingly heavy, like he was made of metal. He was a mottled brown and olive color, with a red place on his throat which he puffed out at me. The IC case was firmly glued to his lower jaw."

There was another interruption for a steak alarm, this time with a couple of blasts on a hockey fan's Freon air horn, and a couple of gunshots, which sent the strangers in the trench coats scurrying for cover behind the meat case in the corner. One of the bleary-eyed snowmobilers started out singing a verse of the engineer's song. A couple of the guys in our group started to join in, but they were promptly shushed. The rest of us were interested in the story and it was getting dangerously close to closing time. I didn't want to get stuck with a cliff-hanger.

"From there on," Frankie continued, "it was easy. I caught several more of the little buggers in roughly the same way and eventually trained them to retrieve more tools and parts than they stole. Some of it was pretty weird, but enough of it was salable to make a handsome second income for several years. I fitted 'em out with little stainless steel collars, like cormorants. That way, they couldn't swallow anything big, and had to live on the lockwashers and little stuff I fed 'em. I even sent through a Minox camera on one of the collars. Most of the time I didn't get very good pictures, same trouble as before, only the other way around. I did get some wild pictures, though, and this was the beginning of the end of an otherwise sweet setup. I began to get frightened. Remember the Russian transistors?"

Several of us nodded. Frankie had had quite a deal on some "surplus" Soviet computer boards and components.

"Well, that wasn't the half of it. Some of the pictures I got back just had to be secret government stuff, and some of it was just plain ridiculous. It didn't even look like it was made by *humans* if you follow me. Finally Athelstan, he was the one I caught first, you know, brought back this. And right then, ladies and gents, was when I got out of the trained glitch business, and went on a nice, long vacation. If you study it, you'll see why."

With that, he tossed the gadget he'd been holding onto the table, chugged the last of his beer and made for the door. The two guys in the coats got up and followed him out. I picked up the thing and looked at it. It was a kind of key, like those fancy ones that they use in the pick-proof locks on vending machines, only a lot more complicated. It had a nylon cord, like a neck loop, and was covered with serial numbers. It gave the impression that if you asked NASA, or IBM, or somebody to come up with an absolutely foolproof lock and key, cost no object, that this would be it. Oh yes, there was a name in front of one of the numbers: "Sandia Corp."

Right about then I noticed a weird, gargling sound, as if somebody down the bar was trying to strangle a Springer Spaniel and not quite succeeding. It was coming from that SAC colonel. He was turning purple in the face and looked like he was starting on a real conniption fidget. He gasped and motioned to me for the key. I flipped it toward him, but it sort of bounced on the table between us, and just kinda, well, winked out!

In a few minutes, the place was full of Air Police, the FBI, the CIA and the Mounties, as if they had all come down a rope . . .

He looked kind of befuddled for a second, then got up, sort of shaky-like, and ran over to the phone booth in the other corner. It didn't do him much good, of course, because there's no phone in the Antlers phone booth, just an obscene parrot. Not only that, but the parrot is stuffed, as is cousin Suomi on the third stool down from the snake.

The colonel came to his wits, finally, and ran outside to his car phone. In a few minutes, the place was full of Air Police, the FBI, the CIA and the Mounties, as if they had all come down a rope. They gave us all a hard time, keeping us in the place for an hour after closing for questioning, but they never found the key. They really went over the building, too, with metal detectors, and magnetometers. They looked behind every brick and under every floorboard, but to no avail. I think they're still keeping a pretty close watch on all of us regular customers. My telephone sounds like the click room at a relay factory when I pick up the receiver, and my third grade teacher has been interviewed by six different agencies, and offered two bribes.

We never saw anything more of Frankie or the coatmen, but once in a while, when I'm finishing a beer just before last call at the Antlers, I catch a flicker of motion out of the corner of my eye. I like to think that Athelstan and his friends have found a new home. ■

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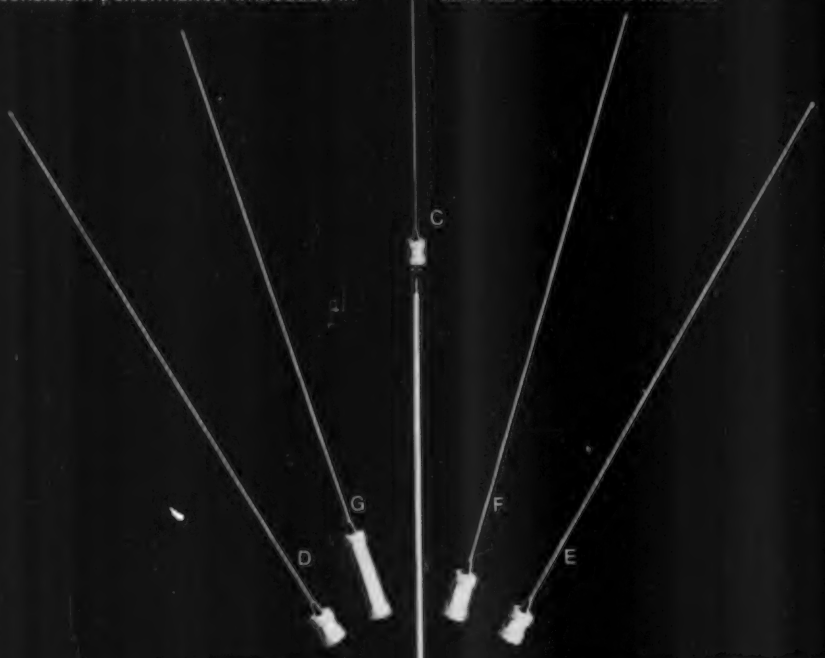

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One of Murphy's Laws must be "He who fiddles with radio is going to get electric shocks." I can't tell how many shocks I have had, and almost every active amateur must have had at least one bad shock sometime. Despite the fact that most amateurs have high voltage power supplies, the greatest number of electric shocks come from the ac power mains. I know that most of mine have been ac, and when I asked my friends about their shocks, they agreed with me. The start of this train of thought about electric shock was the 264 volt wallop that I collected from my son's 24 volt electric train set, but more of that later.

One of the greatest dangers of electric shock is its unexpectedness. One minute you are quietly working on the rig and then "Wham," you get a terrific jolt down the arms and chest, and if you are lucky, you yell like mad and curse a bit. "Damn thing bit me," you say, amongst other things. Of course, if you are unlucky, you don't say anything, anymore, and QST has another entry for its "Silent Keys" column.

Most electric shocks come through sheer carelessness. Ac switches placed at the bottom of a chassis are a good way to collect a jolt through the fingers. If you must place switches there, protect yourself from the terminals by wrapping the switch in a small plastic bag or covering the terminals with electrical insulating tape. Transformer terminals should also be covered with a strip of tape. If you must work on equipment that is live to a hundred volts or more, wear rubber gloves. I have saved myself many a shock by this simple method.

Over the years I have had several severe shocks, mostly through my own carelessness. The most severe shock I ever had was due to neglecting the first rule of safety: "Switch it off first." I had been appointed Radio Operator on a one time U.S. Victory ship, the ex "Norway Victory." She had an RCA 4U Radio Console, where the main transmit-

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ter B+ of 1500 volts was supplied by a motor generator. The B+ was fed to the transmitter through a long fuse, mounted by the generator starter panel under the console desk. The fault was quite simple, no B+. The fuse, a long brown bakelised paper tube with brass end caps, was probably blown, so without turning the motor off, I grabbed it. It grabbed me too, all 1500 volts of it, and I got an almighty shock which caused me to leap back, cracking my head on the underside of the desk as I shot past. When I had recovered and turned the motor off, I found that some previous genius had also had fuse trouble, but no spare fuses. He had solved his trouble by repairing the fuse; unfortunately for me he had soldered the fuse wire from brass cap to brass cap OUTSIDE the tube. The fuse was indeed blown, but I had made contact with the part of the fuse wire that was still connected to the B+. Naturally, I cursed the fool who had done this, but in truth I was the fool for trying to change fuses in a 1500 volt line with the power on.

Of late, after eleven years ashore, I have become more safety conscious. I have had an amateur station for ten years, but have not had many shocks from it. The first shock I received when pulling the transmitter panel and chassis from its case. The ac switch is at the bottom corner of the front panel, and to ease the chassis from the cabinet I slid my fingers under the panel. Yeeowww! I have now taped the switch terminals, but for greater safety, all the ac power cords are only long enough to mate with their respective power sockets when each piece of equipment is in its case. To remove any unit in the station, it must first be unplugged. If I need to work on a unit out of its case, it must be deliberately patched with a power extension cord.

Another safety feature is that all equipment is encased, and the cases are connected together and to ground. In addition, the station ground system is entirely separate from the waterpipe ground of the house electricity supply. This completely separate ground is a great help in avoiding TVI caused by rectification in electricity supply grounds, which may be fine for ac but are ineffective at rf. In addition, the ac line to the rig is only grounded to the station ground.

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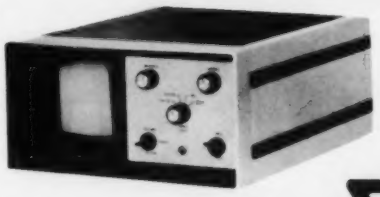

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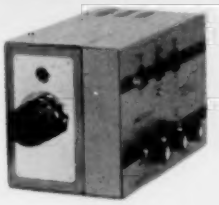

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safety, our local supply authority requires that all power sockets be of the three pin type, with the third pin grounded. All appliances with a metal case must be connected by 3 core flex and three pin plug. Thus, any appliance that develops a short to case will blow the house fuses and protect the user against shock. Every appliance in my house has been checked for safety and found to be in order. All cords were tidy and properly connected, switches were in the active line where only a single pole switch was used, and I was rather proud of my nice safe house. Pride comes before a fall they say.

A couple of years ago, my son was given an electric train set. It was secondhand, but apparently in good order. It uses the all ac German "Marklin" system, using a third rail of studs between the tracks to provide 16 volts ac for the locomotives, plus a 24 volt ac pulse for operating the locomotive reversing switches. I checked that the transformer case was grounded, and that the 16 and 24 volt supplies were the correct value. What I did not check was that the rails were grounded; I merely checked the voltages from center studs to track. The system worked well and it was regularly used indoors. One day recently my son decided that he wanted to use the train set outside in the garden. The track board was placed on the grass, the transformer connected to the track, and the 240 volt mains connected to the transformer, with an extension cord. As I put the locomotive on the track I received an almighty belt that knocked me off balance. I yelled "Turn it off!" and then sat down to recover. I had no doubt that I had received a full mains shock, but how? It was a safe low voltage train and I had checked it. As I thought about it, I realised that I had been between track and ground as I put the loco on the lines, so I put a voltmeter between track and ground and switched on. The reason for the shock was clear — 264 volts! Again, how come?

After disconnecting everything — boy, was I careful now — I examined the transformer. What I found in the box was not a low voltage transformer at all, but a very old radio transformer which some genius had worked out as a cheap replacement for the original. His wiring certainly provided the voltages required, but by

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autotransformer action he had left the track live at 264 volts to ground. By feeding 240 volts into a 210 volt tapping he had increased the 5 volts plus the 2 x 2.5 volt winding outputs to 16 volts, but what a death trap!

Before you have your next QSO, have a look at your house. Is everything electrically safe? If not, fix it fast or call an electrician. Have a look at the rig. Are the cases grounded? Are the cases on a good separate ground? Are there exposed B+ or ac terminals? Can you get across transformer or switch terminals while working on the rig? Think, for a minute, of your family, of your insurance company. ■

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received the filter in one week.

This filter is installed in place of the present 6-pole unit, model XF-30A, designated as XF-1 on the schematic. This is on the I.F. UNIT, plugin (held in by screws) circuit board, which is easily accessible, from the top of the rig. The A.F. UNIT has to be removed first, which is also a plugin circuit board, before you can remove the I.F. UNIT board.

Using a little care and working slowly, the time required from unplugging the boards, switching the filters, to replacing the boards can take less than an hour. Don't forget to remove the old filter's two hold-down nuts and lockwashers, prior to unsoldering! The greatest time is spent at unsoldering, and at the same time, working the old filter out of the I.F. UNIT board. Take your time here. When the old filter is finally removed, carefully clean out the filter's printed circuit connections' holes and your new filter will literally drop right in.

Holding the new filter in place, replace the hold-down nuts and lockwashers. Solder the connections. Plug the I.F. UNIT and A.F. UNIT boards back into the transceiver, fasten the holding-screws, and fire up!

Results

The first thing I noticed was the sharper tuning on SSB. With the old filter, the signals used to "plop right in" as I tuned across the phone portions of the bands. Now, I have to tune a bit slower. One quickly gets used to this. The new filter reduces and practically eliminates "monkey chatter" and "growls" caused by adjacent signals. The eight-pole filter certainly performs better than my outboard audio filters! ■

Reference

1. Yaesu Musen USA, Inc., 7625 E. Rosecrans Avenue, Unit #29 Paramount, California 90723. "XF-32A, 8-pole, SSB Filter for FT-101B." $49.00 plus $1.00 postage.

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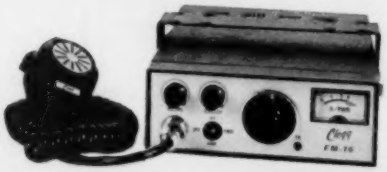

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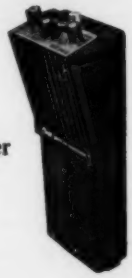

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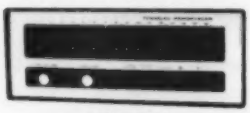

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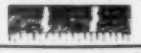

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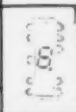

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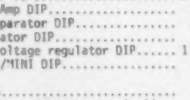

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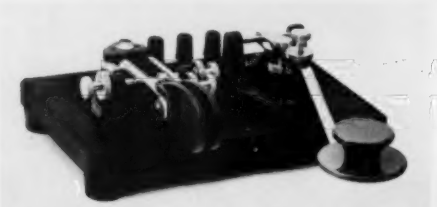

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144-148 MHz

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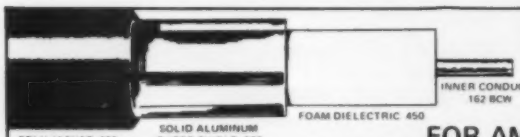

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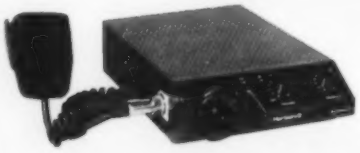

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by
Arthur Eckman WA2ECI
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Having two Heathkit SB-10 sideband adaptors for use with my Apache, I converted one to 160 meters for use barefoot or with my Apache final. There is at the input of the SB-10 a pair of 45 degree phase shift networks, providing a total of 90 degrees rf phase shift. Each consists of a series of exact value capacitors (one for each band), and a ½ percent 50 Ohm resistor.

I used the 80 meter position of the bandswitch for the 160 meter conversion, as that provides the most inductance in each tank circuit. The value of the 160 meter phase shift capacitors was determined in the following manner: First a graph was made of the provided phase shift capacitor's values versus frequency. Then I extrapolated the graph to get an approximate value for the capacitor for 1.8 MHz. It turned out to be 1200 pF. I then purchased a pair of 383 pF capacitors which when added to the existing 817 pF 80 meter capacitors provided 1200 pF each.

The various tank circuits were padded to 160 meters as follows: 120 pF was added across each section of the dual 50 pF balanced modulator tank variable, 36 pF was placed across the 80 meter coil in the 6CL6 tank, and 150 pF was placed in parallel with the 6BQ5 tank variable.

With the balanced modulators unbalanced, about 2.5W of 160 meter input yielded over 5W of output. Sideband suppression was about 30 dB at a frequency of 1.880 MHz, plus or minus 5 kHz.

Desiring to use the SB-10 at frequencies below 1.850 MHz, I determined a more appropriate value for the 1200 pF phase shift capacitors. Using the slope of the graph at 1.8 MHz, I calculated I would require 1240 pF capacitors. With these capacitors in the circuit maximum suppression was at 1.825 MHz.

Normal operation can be restored on other bands simply by removing all padding capacitors.

I drive my 160 meter SB-10 with a hastily built novice special from the *Handbook*. To use the Apache pi network on 160 meters, place the bandswitch in the 80 meter position, and add the capacitors shown in Fig. 1. Put 730 pF at 2000 volts in parallel with the plate tuning variable capacitor and 3150 pF in parallel with the loading capacitor. The capacitors used for the phase shift network can be obtained for $2 apiece from: Leeds Radio Co., 57 Warren Street, New York NY 10007. ■

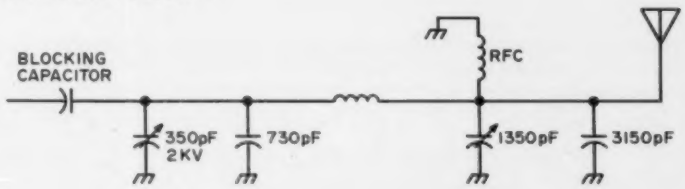

Fig. 1.

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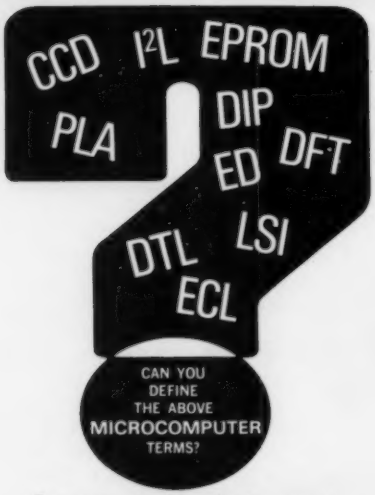

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WH6DBF - K1OXK - W6LZJ

Who can say where it began or how it got started? One just knows that suddenly there was this desire to communicate by amateur radio. I suppose watching my father building that Harkness two tube reflex and later as he assembled the parts to our first Atwater Kent on the "breadboard," the "bug," as it was once called, bit me! I had my turn at winding coils and putting together crystal sets for the boys down the street. (Early 1920s.)

Certainly, I shall never forget the day I completed the "Junk Box Short Wave Receiver" as per the instructions in Radio News Magazine. It had plug-in coils wound on the base of old radio tubes; some of the coils being somewhat longer were wound on toilet paper cores and then glued to the tube bases. Carefully, I hooked up the batteries and turned on the filament switch. It worked! I shall always remember that British accent as the announcer said: "This is GSD, Chelmsford, England....the pride of the British Empire." (Late 1920s.)

My first transmitter was a 20 A operating just in the high end of the broadcast band. I tucked the telephone type carbon mike inside the horn of the Edison phonograph, and cautioning one of my brothers to keep the spring wound and the record playing, I hopped on my bike and off I went to my grandmother's house, about three miles away. Lo and behold I found it on her Atwater Kent Radio. The Dance of the Hours was not loud but to my ears it sounded just great. Wonder if they had an FCC in those days and if they did would they have taken me in? If not, would what I have told you here be a case for a retroactive hustler?

From the day I was able to hear Hersh Calvert and the hams of Pasadena on my junkbox radio, I knew that some day I would be a ham too. A friend of mine at John Marshall Jr. High School by the name of Harry Grace was a ham radio operator and showed me his station. However, he only operated on CW so that as I did not know the code well enough to copy, I was not greatly impressed with Harry's station. Later I was to be permitted to speak into the mike at Dow's Radio Store on Colorado Street in Pasadena. Dow had his big rig just inside the front

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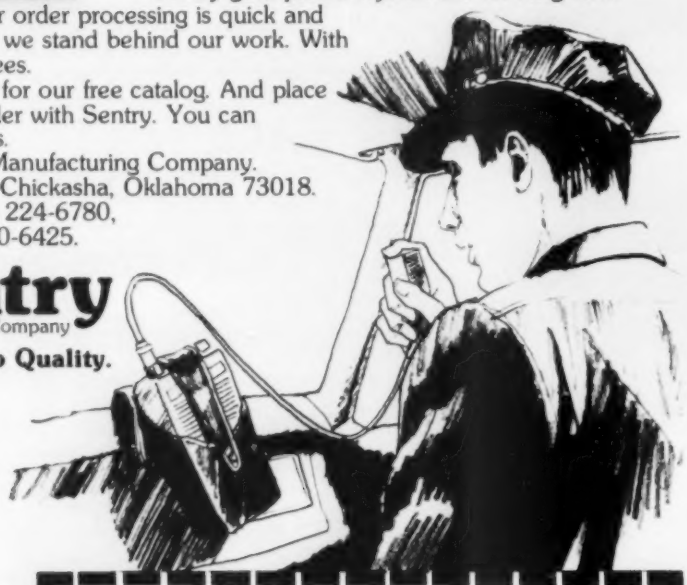

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window in those days. I joined his ham radio class but I just didn't learn the code fast enough.

The day World War II ended I stopped at a drive-in in San Clemente to get a cup of coffee. There I met a ham whose call I've since forgotten but I caught the bug again from him. Somehow I acquired a beautiful Scott or McMurdo Silver Radio in a chrome or nickel plated cabinet. How that cabinet shone when polished; you could see to run the comb through the locks (in those days I had hair). It was there that I learned to light up a defective flourescent lamp with the rf generated by a low power oscillator.

One of the lads in our Rotary Club High School Youth Group by the name of Ted Casad showed an interest in studying for his ham ticket. So thinking that I too would get mine, I worked with him through the hours of sending and receiving code and studying the theory. When we went to the FCC offices in San Diego, Ted passed the code test, I flunked. Ted became W6AMP. How appropriate after all that study....to get A M P.

When we moved to Honolulu, Hawaii and St. Peter's Parish I purchased an Hallicrafters SX-28 and listened to the hams whose ranks I still longed to join. I became acquainted with KH6BFF "Baker, Fox, Fox." Is there a ham who hasn't worked Smitty? He has handled traffic for and in and out of the Islands before, during and after the war. Whenever Smitty signed his call to end a QSO, there'd be another call waiting, usually requesting a phone patch into the Islands. Smitty is as hospitable in person as he is on the air. You would never know that he has a sight handicap unless you were to visit him.

One day while visiting the Mental Hospital on the windward side of the Island of Oahu, I noticed a fine beam antenna riding high on a tower. I rang the doorbell wondering what I might say as an excuse for stopping. The greeting I received quickly dispelled my misgivings and soon I was looking at a ham radio station shared by Bernie and Kayla Bloom (who later became editor of *73*). I learned that since Bernie was a psychiatrist on duty at the hospital most of the day, Kayla was able to take advantage of the band openings which were very good in those days.... 1958 - 1959! Kayla had a contest going with Bernie and the results were depicted on a huge map displayed on one wall of the shack. There were two colors about evenly divided around the world as the

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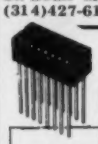

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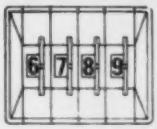

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pins represented their DX contacts. I was invited by Kayla to visit the HARC, The Honolulu Amateur Radio Club, which met at one of the U.S. Army Forts out at the end of one of the buslines from town. It was dark there at night and not easy to reach after hours. Later I was to be the instrument by which the board of directors of the club were to be persuaded to move the club meeting place to the parish house of St. Peter's Church.

Fate had finally smiled upon me! One of the clergy stationed out at Wiamanalo Beach, Lamar Speiers, was a ham radio operator. I met Lamar and through his assistance and guidance learned the code, the theory and studied once again for that so elusive ham ticket. Yes, I finally passed the examination! While waiting for the call to arrive, I met a ham who was going to get married and whose fiancee wanted him to give up ham radio, first! He had two Heath Kit rigs for sale. One the DX-35, the other the Apache. I bought both in my enthusiasm. Neither was in working condition so that when my ticket arrived one really gorgeous day in December of 1958, I got that DX-35 out on the floor and compared it with the wiring diagram (yes, fortunately it came with the rig). Ah, there it was, one of the wafers of the band switch had a broken or missing contact. I installed a SPST toggle switch in such a manner that when I reached into the cabinet by sticking a lead pencil (eraser-end-first) through a tiny hole in the rear of the set, I could just throw that switch. It connected an rf bypass condenser to ground...or did it?

By noon of the day my call, WH6DBF, arrived I was on the air calling "CQ, CQ, CQ, de WH6DBF, WH6DBF, WH6DBF k." I was answered immediately by a ham in Pearl City out by Pearl Harbor. 40 meters was working!

I ordered a custom 3 element monoband for 15 meters. It was made for me by an antenna manufacturer in Honolulu. Finally, one Saturday afternoon, one of my congregation, David Chang (also a ham radio operator, though not active at the time), Smitty KH6BFF and other ham radio operators in town converged on St. Peter's Church and helped me install the beam atop a rotor and mat on the roof of the rectory.

I am afraid I spent more hours that first year than I should have in CW QSOs

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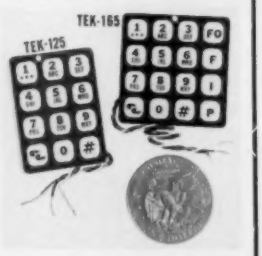

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around the world. My goal: to get that General ticket before the Novice ticket expired.

In August, 1959, I was invited by KH6CUP, the president of Precision Electronics (my favorite ham store in Honolulu) to man a Novice booth at the 1959 ARRL Convention held in the Kaiser Hotel Building. I won only one contest in my life and that was during the convention; I was given a set of crystal earphones as a prize for having the most verified DX QSLs in the Novice class. I still have those lightweight "cans."

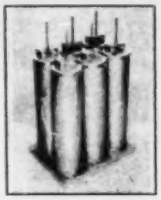
The definition for privilege in the American Heritage Dictionary here at my desk is: "...benefit enjoyed by an individual or class." I like that! How better can one describe the thrill that goes with passing on to others the know-how of ham radio? It is definitely my privilege as a radio amateur to give to men and women who are interested the opportunity to become licensed amateurs. Just as soon as I was oriented as a Novice, the station operating, the antenna trimmed and set, my QSL cards printed and the ink scarcely dry...I was organizing a class for Novices and Generals. David Chang of my congregation who did so much to assist me in Honolulu took the class for Generals; I took the Novices.

If you ever get the chance to visit the HARC in Honolulu, do so! I have never seen a more dedicated group of men and women, boys and girls as constituted the Honolulu Radio Club. Hams came from the other islands to make the meetings. Young people sat up front busy taking notes while the speaker for the evening told us of the mysteries of skin effect and the ins and outs of swr. After the serious part of the evening was over, there was a big drawing for the many door prizes, a chance to swap one's "goodies" for someone else's. The refreshments were often homemade and donated by one of the YLs, or are they Female Radio Persons these days? I loved them all.

Suddenly, it was all over! We packed all our earthly goods in a sea van including the ham radio gear. I made a presentation of the 15 meter beam to a friendly young Novice in Honolulu. We sold our Wurlitzer 2-manual spinet to another ham friend, KH6OES, and embarked for Boston, Mass.

The night of December 1959 when my Novice ticket expired, I sat up until midnight wishing

DUPLEXER KITS



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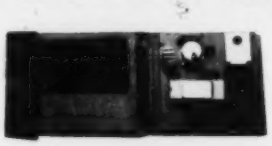

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that I had a rig for a last CW 73. I had tried all over Boston to find one ham who had a Novice rig he might let me borrow for that last night. It wasn't to be. Perhaps, however, it became a spur to go on for the General. I learned that one could study for a ham ticket at MIT in Cambridge, Massachusetts. It was there that I met Bill and Marie Welch; it was there that I took the Technician test and then dropped out because of the press of church activities in Boston's South End. I was stationed then at St. Stephen's innercity mission.

When K1OXK came through the mail, I bought a Gonset Communicator 3. I met hams all over the state. I joined the Six Meter Mobileers and the 51.30 Club which met on the air every night to chat and once a week for business at 51.30 MHz (only it was MCs in those days). The social affairs of the fifty-one-thirty club were great. I still miss the contacts I made on six meters. They were gentlemen and ladies all.

It was through a contact on six meters that I met Joel Nichols K1MUE. I was later to be asked to join that confirmed bachelor in Holy Wedlock with the widow of another ham friend of mine. Joel and Gladys were married in the home of K1KQJ, Karl Miles, the friend of every six meter operator within working distance of his hilltop home in Wilton, New Hampshire.

Our first Vicarage in South End Boston was two doors from the New Haven railroad line. If I happened to be on the air when the train came by, I took a bit of ribbing from my friends in the QSO. "Why don't you get off the track and let that train go by?" "Is your shack built over the tracks?" In the second Vicarage we were ensconced in a former hotel for women provided the church by the YWCA. The shack was in a corner room on the fourth floor. Ed, from "the garden spot at Scituate on the south shore" helped me get the six element Hy Gain beam installed. You would have appreciated the stir we caused when Ed decided we didn't have to disassemble the beam when it came down from the roof of the small four story tenement by the New Haven tracks. Tied to a rope and dangled over the edge of the roof, the antenna was lowered slowly to the front walk. Ed took one end and I the other and with 20' of boom and all the elements intact we began walking the ¾

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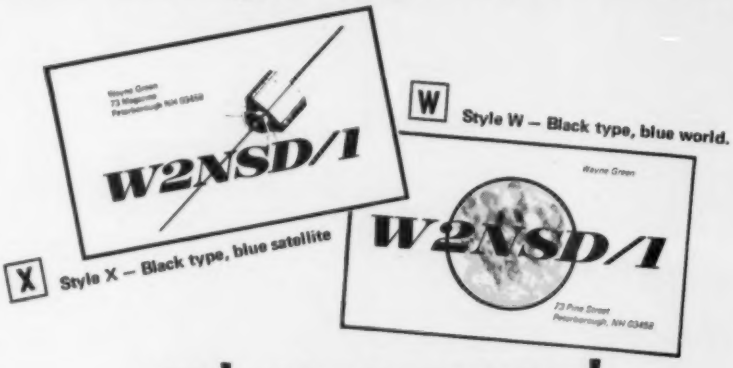

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of a mile that led to the new QTH. Traffic, both mobile and pedestrian stopped to gander at this contraption with many arms and four legs maneuvering down the walk. "What is it?"

It seemed appropriate at the time to respond with: "It's a TV antenna for getting stations from out of state!" I'm sure many thought that that was just what it was.

One hears a great deal of conversation about hams who stay on six and two meters, content to operate with Technician class licenses. Certainly there is much to be said for doing so; I enjoyed those years beyond anything I can now tell you. Friendly QSOs every evening I was free to operate. Volunteers when needed to help install another new beam or to repair an old one were available as close as the microphone on my rig. DX was just as thrilling on six meter skip and when working the aurora as it had even been on the low bands.

You might wonder then why it was that I even bothered to go for the General ticket. I remembered Bill Welsh's admonition: "Don't get stuck on six meters...go for your General!"

I had only tried once to pass that insurmountable hurdle and that had been in Honolulu. I was at that time more concerned about passing the theory than I was about the CW test. After all, I was in CW QSOs at some time of every day — working actually around the world. For every DX contact I would answer requests for contacts from California and every other state in the Union. You know what happened, of course! I flunked the code test! All the numerals sounded like Js and Zs!

In 1964 we moved to Andover and took a parish in Lawrence, Massachusetts. Here I had the use of a rectory, a ranch style house with a full basement. One corner of the basement had been partitioned off as a den. It was here that I set up the six and two meter rigs. By this time we had disposed of the Gonset 3, purchased and used for some time a Gonset G-50, and now owned a Clegg Zeus and Interceptor for six and two meters. Shortly after moving to Andover I arranged to spend a few hours each day copying the code tape on a government surplus machine. Finally, with new confidence in my code speed and accuracy I thought I was ready to go before the FCC examiner.

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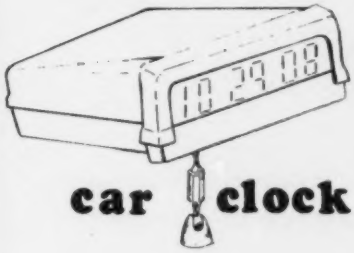

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I made arrangements to take the General examination at the New England Hamfest in the New Ocean House Hotel in Swampscott. My friends cautioned me that it would be harder there due to the confusion and noise. I was the last one to be allowed to "send" the code after passing the receiving test. Thus, as I recall, among the last to enter the other room where the test for the theory was being administered. I finished so soon that I thought I must have missed something, and took another look before turning in my test. You know what a thrill it was...when I came back and read my name up near the top of the list of those who had passed!

Now, it was a whole new ball game; only a ham who has been on six meters or two with no hope of working the low bands can know how difficult it is to get into a good CW contact on a regular basis. I had missed those CW QSOs in the Novice portion of 15 meters...a window wide open to all the world with a vast view of all the continents and many ships and islands in the seven seas.

One half of my shack now became a low band station with "my poor man's Collins: the SX 117 and the HT 44, matching units by Hallicrafters." The rectory yard on the west side now became a small antenna farm. Inverted Vees for 80 and 40 meters, a 2 element Hy Gain beam for 10, 15 and 20 meters, and stacked six and two meter beams. I've never had it so good since!

Here in Long Beach, California, we live in an apartment, and while our landlord is a former ham, there really isn't much room for a satisfactory antenna installation. I live in hope; if any K or W6 reads this sad tale, and wants to make a fellow ham happy in his "old age," please drop by and let's see if we can't put up an antenna that will at least work Honolulu. I hate to think that I will have to move back to New England to get on the air again. Still it wouldn't be such a bad idea; I'd like to see and talk to my many friends back there once again. One more reason for having an antenna that works at my present QTH!

By the very nature of my profession I meet many people of all ages and races. But if I had to choose a hobby to take the place of ham radio, I'd be lost. Nothing I can think of takes the place of amateur

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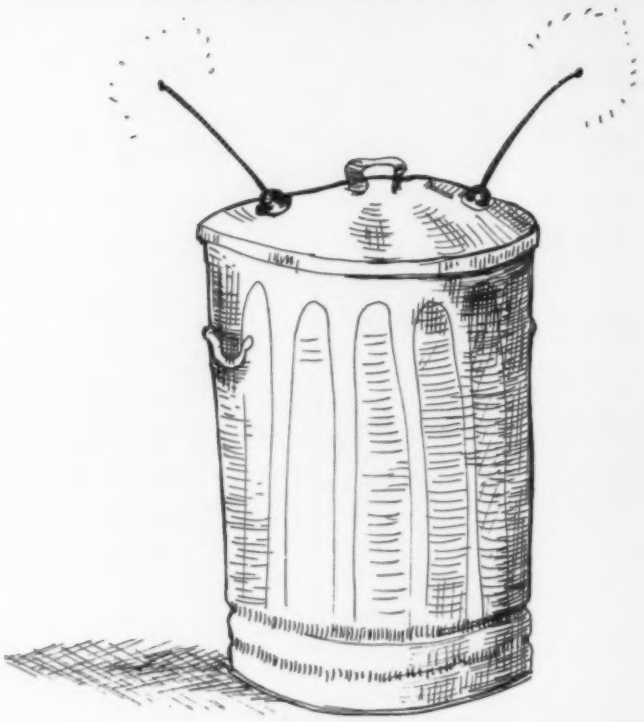

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radio; I sincerely hope that in the years to come every generation of young people will be encouraged to become amateur radio operators and to use their talents to communicate across the seas and perhaps some day throughout our solar system or beyond.

Once a year in the early fall when the resort rates fall to levels a ham could afford to take advantage of, a group of six and two meter hams used to get together for a weekend of food, fun and fellowship. A fine supper around a large table, a speaker or just table conversation during the evening and then the next morning after early coffee together we'd go somewhere for breakfast. Our genial host for those Friday night affairs was Jim K1VPE of Moody Beach, Maine. His XYL Betty would have everything all set and ready for us when we arrived. Jim would open up his private den (like a small night club with tables and spectacular paper on the wall...and a dandy bar) to our small group. One of the rare treats that were a bonus of those weekend retreats was to awaken early and walking upon the beach see a Canadian goose land on the sand nearby. What a proud bird they are. No prouder bird than that ham who for the first time opens the envelope and removes his FCC ticket to the airways. No prouder member of the human species than that ham who having built his first rig, turns it on and it works! No happier ham in all the world than the operator who having called his first CQ....hears his call coming back from another station....down the street or from across the world it's all the same!

I know I could write a book about the fun and people I've met in ham radio. There just isn't room in 73 Magazine for it; but I am pleased that I had this opportunity to share some of it with you. If any of those fellows I've had the pleasure of helping to get their tickets should read this, I certainly would like to hear from them. Where they are living, what sort of a rig they're running and what's new with them since we last talked.

If you are not a ham and are looking for a way to make lasting friendships and a hobby that's enduring, write me or visit with your nearest ham and go with him to a ham radio club. You'll be glad you did! ■

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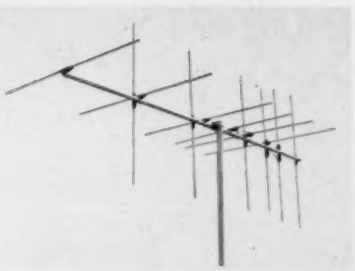

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In fifteen years of commercial broadcast experience, I have only needed to ask outside help two or three times. Of course, in a number of situations, there was another engineer working with me on a project, and two heads are better than one; but more often than not the broadcast engineer, as well as the amateur, is on his own. Using common sense and remembering his theory will solve almost any problem that comes up.

Most troubles that happen can be listed in six categories. Arranged from the simple to the complex:

1. Tube troubles.
2. Power supply troubles.
   a. Plug it in
   b. Blown fuse
3. Misadjusted circuits or controls.
4. Dirty contacts or controls.
5. Loose or broken connections or wires.
6. Deteriorated components.

Tube troubles happen most often and are relatively easy to correct. First, look to see if all the filaments are on. Simple as this sounds, there are many people who don't do it. Find out which circuit doesn't work and substitute tubes in it; or better yet, check them all in the tube tester. One of the first things I bought when I established my amateur station was a reputable tube tester. The Eico 667 comes in kit form, is priced right, gives a valid test, and has instructions on how to set up for new tube types. An adaptor is available for testing older tubes in case you run across an 83 or something; a magnoval and ten-pin adaptor are also available.

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This unit comes with a pilot light checker in the novar socket. I replaced the socket (30 cents or so) because many novars have the air seal at the bottom, and this prevented the tube from being inserted in the socket. (Pilot lights can be checked from the grid cap to ground.)

It is a wise practice to throw away weak or burned-out tubes. It is also wise practice to keep a spare or two around just in case you lose a tube at 5:10 pm Friday and your friendly parts house won't be open until 9:00 am Monday. I keep at least one spare for every tube type, or if more than six are in use, at least two spares. For finals, I keep two so that they will be both of the same approximate age in case of being changed. Tubes don't cost so much that the smaller receiving-types can't be kept on hand. The popular 6146 is relatively inexpensive, although a 4-1000A is a different story.

From experience, most power supply troubles are caused by something not plugged in, like the ac cord, or a more exotic example, the rectifier plate cap is not connected. Look for dirt on the plate cap. It goes without saying to look at the fuse early in the game; I learned this one the hard way once.

Most amateurs should be able to locate misadjusted circuits or controls. Tanks may not be at resonance. Neutralization may not be correct. Bias or drive may not be proper. A good VTVM and VOM are worth their weight in Extra Class licenses at this point. I have one of each. Eico and Heath make excellent kits, or you can go full blast and get a Hickok or Triplett. After building my kit, I sent it to the repair station for calibration since I also use it in broadcast work. Not having a voltage standard available, and not relying on the power company's 105-130 volt source, the $5 was well spent. With these units standardized, you can calibrate other equipment against them.

At one broadcast station, the FCC required the power to be reduced at local sunset. This was easily done by operating a switch marked "1000-250" on the transmitter. One operator somehow got confused and operated the control marked "Buffer Tuning." This took out two 807s and a fuse.

Dirty contacts are responsible for many things misfunctioning but can be difficult to find. A regular program of squirting contact cleaner (don't use carbon tet) into all rotary and lever switches and into all relay contacts will make troubleshooting ex-

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MT-13	30 to 50 MHz	30 Watts	12 v. transistor
MT-16	30 to 50 MHz	60 Watts	12 v. transistor
MT-17	30 to 50 MHz	100 Watts	12 v. transistor
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peditions as rare as a contact with Tibet. A contact burnishing tool is quite useful, but please don't use a nail file. One way I have used to locate the more exotic problems of this nature is to put an audio tone (I like 400 Hz) on the line in question and trace the signal with a scope. With a scope you can tell the frequency of the signal, whether any attenuation has acted on it, or amplification; you can see extreme distortion, and if there is no signal where there should be, you know the circuit is open.

One broadcast station had several clip leads connecting various parts of the audio console. When rewiring the control room, I removed the leads and found one of the output channels didn't work. Using the signal generator-and-scope method, working back from the output, I found the signal was blocked by DIRTY SWITCH CONTACTS. Somebody had used these leads to bypass the switch instead of squirting the cleaner into the contacts.

Loose or broken connections can be braincrackers, especially the intermittent type. After disconnecting the ac and grounding all filter capacitors and high voltage points, pull and shake every wire you can find. Using an ohmmeter can show high resistance connections that shouldn't exist. After using the equipment, and removing all voltages, look for warm places (current thru high resistance means heat). Of course, if smoke comes out, you can find it right away. Check all connections against the diagram; check all socket voltages and resistances. In one commercial transmitter I found a missing ground wire on a meter switch rendering two positions inoperative. My own scope stopped working once; a filament lead rubbed where it went around a corner, shorting to ground, hence no filament voltage. Find out which sections work OK and which don't. Modern plug-in transistorized modular construction is wonderful. Pull out the defective board and plug in one that works, then do the maintenance at your leisure.

The operators at a broadcast station once told me the transmitter would turn itself off and they'd have trouble getting it back on. I figured they were running it wrong since I never had the trouble. One night, during routine maintenance, I couldn't get it to go on either. After three hours of pulling, pushing, kicking, tapping, etc., I saw an arc in the output section. The trouble was in a variable inductor —

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the contact wheel was not making good contact and opening, and the overload relay turned the transmitter off. A very simple situation that took a long time, and a lot of luck, to find.

After any equipment gets old enough, components will deteriorate. Capacitors and resistors will change values, insulation will crack and peel, phenolic switches and circuit boards become brittle and crack, screws and bolts become loose and fall out, and all sorts of other mysterious things can happen. Often it is easier and cheaper to replace the whole unit than to repair it piecemeal. These printed circuit boards, if cracked, will in effect break the printed connections. Even a microscopic crack will open a lead. A bead of solder down the conductor will repair the break. For transformers and chokes, replacement will be necessary if the voltages deviate excessively from original values. Likewise, resistors and capacitors will have to be replaced if they no longer do the proper job. The enemy of components is primarily heat and dirt. If you keep both at a minimum, you will have minimum troubles in later years.

Place everything so that proper ventilation is assured — this keeps the heat down. Generally, commercially-made equipment and kits are well designed to remove heat properly. Leave lots of room for circulation of air.

Make dust covers for your equipment. At WA6CPP, the XYL is quite accomplished on the sewing machine, and made some plastic dust covers that exactly fit the various components, including the power supply-speaker units. When not in use, these are protected from the ever-present dust filtering in. At one commercial station, nobody dusted or vacuumed for three years before I got there, and the dust had turned to mud. Nobody will get mad if you use the vacuum cleaner to blow the dust out of things once a month or so.

Perhaps some of these suggestions reflect my work in commercial broadcast, but I don't think any of them are impractical for the average amateur. After all, when we have spent many hundreds of dollars and countless hours on our stations, we should take care of them properly. When, from time to time, something goes wrong, the license holder should be able to fix it. In some cases, you may have to use the land line to call your friend across town to give an assist, but it would be

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CORRECTION

In the article, "Updating the Heathkit IB-1101," in the Nov/Dec issue, there are a couple of mistakes.

In Fig. 2, front wafer, V2 pin 14 and V3 pin 14 are reversed. V3 should be the top lead shown.

The printed circuit board in Fig. 3 has a mistake. The ground connection of the 7490 should be pin 10, not pin 9 as shown. Pin 9 is not utilized by this circuit.

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OUR APOLOGIES to WA2APJ and WB2AQM, for transposing their photos on page 11 of the January issue.

embarrassing to me to send something to the manufacturer or repair station to have a broken wire fixed.

One evening I was trying to get an auxiliary transmitter to work. Having just started to work at the station, I was getting everything in A-1 condition, but it was impossible to get high voltage to that auxiliary. The tubes lighted up OK, and the meter showed crystal current and buffer grid drive, but that was ALL. I was about ready to check for bias voltage when I thought I'd check the primary supply. Well, this rig had two primary supplies — 110 volt single phase and 220 volt three phase. Somebody pulled the breaker on the 220. After that, it worked great. Let's see, that's reason 2, Power Supply Troubles, Plug It In. ■

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The first two numbers of the frequency are deleted for the sake of being non-repeti tive. Example: 146.67 receive would be listed as – 6.67R

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2. 6.61R	10. 6.73R	18. 6.79R	26. 6.91R	34. 6.52R	42. 7.69T	50. 7.81T	58. 7.93T
3. 6.04T	11. 6.145T	19. 6.22T	27. 6.34T	35. 6.94T	43. 7.09R	51. 7.21R	59. 7.33R
4. 6.64R	12. 6.745R	20. 6.82R	28. 6.94R	36. 7.60T	44. 7.72T	52. 7.84T	60. 7.96T
5. 6.07T	13. 6.16T	21. 6.25T	29. 6.37T	37. 7.00R	45. 7.12R	53. 7.24R	61. 7.36R
6. 6.67R	14. 6.76R	22. 6.85R	30. 6.97R	38. 7.63T	46. 7.75T	54. 7.87T	62. 7.99T
7. 6.10T	15. 6.175T	23. 6.28T	31. 6.40T	39. 7.03R	47. 7.15R	55. 7.27R	63. 7.39R
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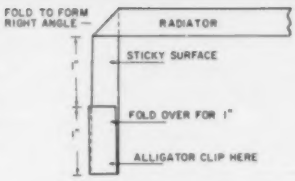

Alarm Foil Antennas

Larry Kahaner WB2NEL
4259 Bedford Ave.
Brooklyn NY 11229

While in my neighbor's house one day explaining how I can phone patch her brother in Germany, I spied a newly installed alarm system. It was the usual type in which thin foil is taped around the window to form a closed circuit. When the window is broken, the foil circuit opens and the alarm sounds. The foil looked so pleasant and neat on her huge picture window. Since I am always looking for new types of radiators (and what ham isn't?), I wondered about alarm foil. Indoor antennas are not new to me. I had some indoor dipoles in my old apartment but they always looked so ugly and had to be removed when guests came. Perhaps foil was the cosmetic answer.

Window foil is not as easy to obtain as one might expect. It seems that the alarm installers want to keep business to themselves and frown on home brewing interlopers. I called a few places and they refused to sell it to me. This is odd because both Lafayette and Radio Shack have it in their catalogs. I finally got a roll from the man who installed my neighbor's alarm. A 200 foot roll cost about three dollars. The tape I bought has a paper backing which is peeled away exposing a sticky foil. I made several tests and found that the tape could be applied to a painted wall and later removed without leaving

a mess. I advise against placing it on wallpaper.

My house has a crown molding on the top perimeter of the room and I applied the tape in dipole fashion starting from the center. At the feedpoint I folded the tape on itself for about one inch. The tape exhibits great strength to pulling apart but will tear easily if twisted. Fold the tape at right angles to prevent the coax weight from tearing it. If you make a mistake or tear the tape, another piece overlapped will make a tight contact despite the adhesive. Check with an ohmmeter if you feel insecure. I thought of different methods of feeding and decided that the simplest was also the best. I used alligator clips from my coax. This would allow me to remove the coax without taking down the antenna. Coax climbing a white wall leaves much to be desired.

With everything in place, I loaded up the rig. My match box was waiting in the wings. My transceiver loaded up easily with an swr of 1.7 to 1. Since my calculations were for the center of 20 meters, I peeled and cut a little off each end until it was perfectly matched for the center of the phone portion. I tuned and heard a very strong CQ from the Midwest. I answered pessimistically and he responded with a 57 report. Other reports from that area were also encouraging.

I added some tape to the ends and pruned it for the low end of the CW segment. That afternoon I worked 2 Gs, 1 I and 1 DK. All were better than 459 reports. Input power was 180 Watts. It is not necessary to add and subtract tape for each segment of the band. It is as broadband as any other dipole but I felt that any extra push was helpful.

The configurations of foil antennas are limitless. If your apartment is the right size you might try putting a reflector or director on an opposing wall in another room. With a matching network you should be able to work the low bands with a shortened antenna. It would also make a great "long wire" for the SWL who is apartment bound. Even though the adage "the higher the better" still applies, if you live on the 29th floor of a 30 story apartment house, the working difference between crown molding and baseboard mounting will be minimal. And, it will be better hidden on the baseboard. Window foil is especially good for sealing rf leaks in home brew chassis. And I have found that a folded dipole of foil hidden on the back of a dresser makes a fantastic antenna for commercial FM reception.

Dipoles can never compete with 4 element quads up 75 feet, and indoor dipoles even less. But for the ham living in the canyons of the big city an indoor foil antenna can be the answer to never getting on at all. ■

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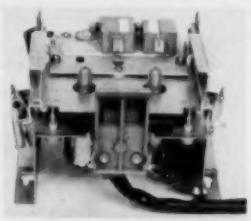

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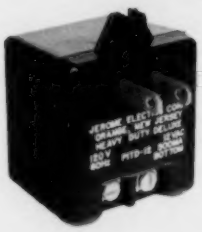

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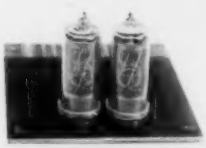

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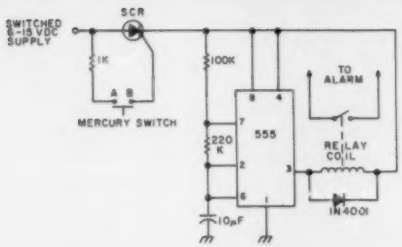

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Once activated, the system cannot be shut off without disconnecting the primary source of power. In the standby or arm mode, the circuit draws no power until triggered. The unit may be operated on any dc voltage between 6 and 15 volts. The relay

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Equipment: mount inside or on the back of the rig — attempts to physically move the equipment will trigger the circuit.

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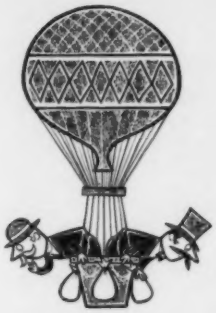
Touch Switch: Sensor leads or a grid board will activate the circuit when touched by hand.

The circuit is simply an SCR switch activated by a mercury switch or sensor lead. Once triggered the SCR remains ON supplying operating voltage to the 555 timing IC. If the alarm device uses 200 mA or less, the relay is not needed. If the load however, uses more than 200 mA a relay should be incorporated and have a coil rating for the operating voltage used.

Due to the limited number of parts in this project, assembly on a small piece of perf board or plastic may be used. The use of a small relay will allow you to build this alarm on a 1X2 inch square board or if a smaller unit is required, the relay may be outboarded.

All components are available through your local Radio Shack stores. ■

The sky's the limit...



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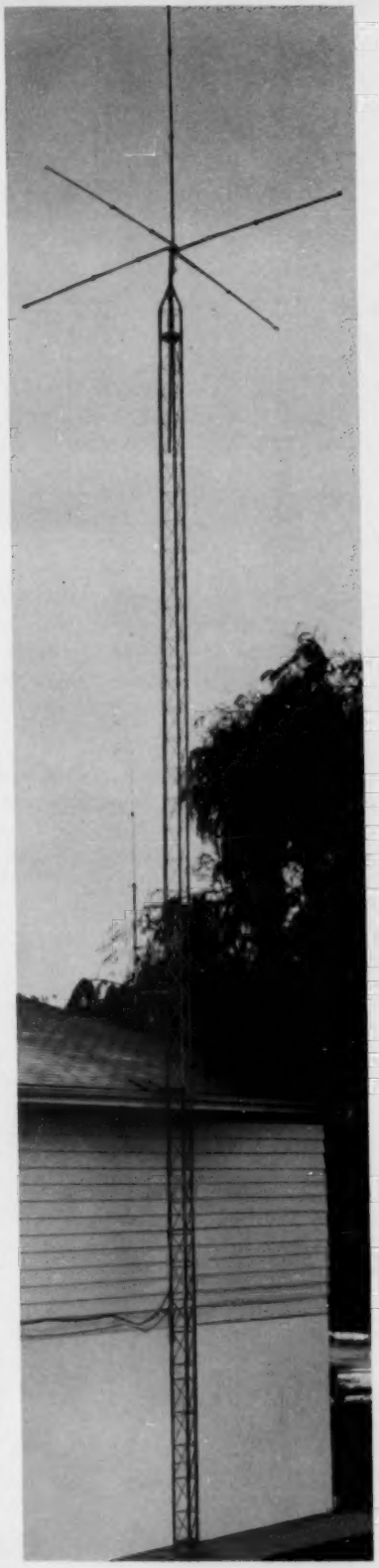

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* Negative or positive logic output, jumper selectable
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* Size – 12¼" x 6¾" x 2½"
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* Electronic shift lock, not mechanical
* Keyswitches one integral assembly, not individual keys
* Switches have four-finger phosphor bronze contacts with gold inlay
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These keyboards are available off the shelf in two forms – fully assembled and unconditionally warranteed against defects in manufacture or materials for a full ninety days, or in the more economical kit version. Kit parts are fully warranteed against defects in manufacture or materials for a full ninety days. In either version, full instructions are supplied for operation, including specifications and data sheets. In the kit version, complete instructions are supplied for the assembly process. A reasonably competent technician can completely assemble and test this keyboard in one evening. All parts needed are included.

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360 Merrimack St., Lawrence, Mass. 01843
Factory Telephone 617-688-0751
Mail Orders 603-434-4644

7400N TTL

SN7400N*	.13	SN7451N	.27	SN74151N	1.25
SN7401N	.15	SN7453N	.27	SN74153N	1.35
SN7402N	.21	SN7454N	.41	SN74154N*	1.25
SN7403N	.18	SN7458A	.35	SN74155N	1.21
SN7404N*	.16	SN74H88	.32	SN74156N	1.30
SN7405N	.24	SN74H78	.45	SN74157N	1.30
SN74H88	.45	SN74H72	.39	SN74160N	1.75
SN7407N	.45	SN74H73	.37	SN74161N	1.45
SN74H88	.35	SN74H8*	.35	SN74163N*	1.50
SN7408N	.25	SN74H76*	.39	SN74164N	1.65
SN74H8*	.16	SN74H78	.32	SN74165N	1.65
SN7411N	.30	SN74H8N	.59	SN74166N	1.70
SN7412N	.42	SN74H21	1.75	SN74167N	5.50
SN74139N	.85	SN74H30	1.10	SN74170N	3.00
SN7414N	.70	SN74H5N	1.12	SN74172N	18.00
SN74H8N	.43	SN74H8N	.40	SN74173N	1.70
SN7417N	.43	SN74H8N	3.50	SN74174N	1.95
SN74H8N	.35	SN74H8N	3.00	SN74175N	1.95
SN7420N	.21	SN7490N*	.49	SN74176N	.90
SN74219N	.30	SN7491N	1.30	SN74177N	.90
SN7423N	.37	SN74H2N	.82	SN74H8N	1.65
SN7425N	.43	SN7493N*	.57	SN74181N	3.55
SN7426N	.31	SN7494N	.91	SN74182N	.95
SN7427N	.37	SN7495N	.91	SN74184N	2.30
SN7429N	.40	SN74H8N	.91	SN74185N	2.20
SN74308N	.28	SN74100N*	1.50	SN74187N	6.00
SN7432N	.31	SN74167N	.49	SN74190N	1.50
SN74378N	.47	SN74121N*	.45	SN74191N	1.50
SN74388N	.40	SN74122N	.49	SN74192N*	1.19
SN74H8N	.35	SN74123N*	.70	SN74193N*	.80
SN7440N	.21	SN74125N	.50	SN74194N	1.45
SN7441N	1.10	SN74126N	.91	SN74195N	1.00
SN7442N	1.00	SN74132N	3.00	SN74196N	1.25
SN7443N	1.05	SN74141N	1.15	SN74197N	1.00
SN7444N	1.10	SN74142N*	4.00	SN74198N	2.25
SN7445N	1.10	SN74143N*	4.50	SN74199N	2.25
SN7446N	1.15	SN7447N	1.00	SN74200N	6.00
SN7447N*	.79	SN74145N	1.15	SN74251N	2.50
SN7448N	.99	SN74148N	2.50	SN74284N	6.00
SN74H8N	.35	SN74150N	1.10	SN74286N	6.00

MANY OTHERS AVAILABLE ON REQUEST

20% Discount for 100 Combined 7400's

CMOS

CD4000	.25			74C10N	.65
CD4001	.25			74C20N	.65
CD4002	.25	CD4030	.65	74C42N	2.15
CD4006	2.00	CD4035	1.85	74C73N	1.50
CD4007	.25	CD4040	2.45	74C74	1.15
CD4008	.90	CD4042	1.90	74C85N	3.60
CD4010	.50	CD4044	1.80	74C90N	2.00
CD4011	.25	CD4045	2.50	74C107B	1.25
CD4012	.25	CD4047	2.75	74C151	2.90
CD4013	.47	CD4049	.79	74C154	3.00
CD4016	.50	CD4050	.79	74C157	2.15
CD4017	1.35	CD4051	2.95	74C160	3.25
CD4019	.65	CD4052	2.90	74C161	3.25
CD4020	1.40	CD4068	3.25	74C163	3.25
CD4022	1.35	CD4066	1.75	74C164	3.25
CD4023	.25	CD4069	.45	74C173	2.00
CD4024	1.00	CD4071	.45	74C193	2.75
CD4025	.25	CD4081	.45	74C221	2.75
CD4027	.60	74C00N	.39	74C906	1.90
CD4028	1.05	74C02N	.55	68C97	1.90
CD4029	2.00	74C04N	.75		

LINEAR

LM106H	15.00			LM1310N	2.95
LM108H	2.00			LM1351N	1.65
LM171H	2.70	LM373N	3.25	LM1414N	1.75
LM172H	4.00	LM377N	1.65	LM1458C	.65
LM308H	.89	LM380N	1.39	LM1489N	1.00
LM301H*	3/1.00	LM380CN	1.05	LM1556V	1.65
LM301CH*	3/1.00	LM391N	1.79	LM2111N	1.95
LM308H	.75	LM392N	1.79	LM2901N	2.00
LM304H	1.00	NE501K	8.00	LM3065N	.69
LM305H	.95	NE510A	6.00	LM3900N	.55
LM307CN	.30	NE531H	3.00	LM3905N	.65
LM308H	1.00	NE536T	6.00	LM555/6N	1.65
LM308CN	1.00	NE540L	6.00	MC5558V	1.00
LM309N	1.10	NE558N	.70	LM7525N	.95
LM309K	1.35	NE563	2.50	LM7528N	2.20
LM310CN	1.15	NE5534N*	.45	LM7534N	2.20
LM311H	.90	NE5539N*	.90	LM7535N	1.25
LM311N	.90	NE5560N*	1.25	80388*	4.95
LM318CN	1.80	NE5562N*	1.99	LM75450	.49
LM319N	1.30	NE5570N*	1.25	75451CN	.39
LM319D	0.99	NE567V*	1.50	75452CN	.39
LM320K-5	1.35	LM703CN	.45	75453CN	.39
LM320K-5.2	1.25	LM709H	.29	75454CN	.39
LM320K-12	1.35	LM709N	.29	75491CN	.79
LM320K-15	1.35	LM710N	.79	75492CN	.89
LM320K-5	10.50	LM711N	.39	75494CN	.89
LM324N	1.80	LM723N	.55	**RCA LINEAR**	
LM339N	1.70	LM723H	.55	CA3013	1.70
LM340K-5	1.95	LM733N	1.50	CA3023	2.15
LM340K-12	1.95	LM739N	1.29	CA3035	2.25
LM340K-15	1.95	LM741CH*	3/1.00	CA3039	1.35
LM340K-24	1.95	LM741CN*	3/1.00	CA3046	1.15
LM340T-5	1.75	LM741 14N	.30	CA3059	2.40
LM340T-6	1.75	LM747H	.79	CA3060	2.60
LM340T-12	1.75	LM747N	.79	CA3080	1.15
LM340T-15	1.75	LM748H	.39	CA3083	1.00
LM340T-24	1.75	LM748N	.39	CA3086	.59
LM350N	1.60	LM1303N	.90	CA3060	3.25
LM351CN	.60	LM1304N	1.19	CA3089	9.25
LM370N	1.15	LM1305N	1.49	CA3123	1.65
LM370H	1.15	LM1307N	.85	CA3600	1.75

KITS EXAR ICS

XR 2206KA — SPECIAL $17.95
Includes manual-the function generator IC, PC board, and assembly instruction manual

XR 2206KB — SPECIAL $27.95
Same as XR 2206KA above and includes external components for PC board

TIMERS

XR 555CP	$ .65
XR 320P	1.55
XR 556CP	1.85
XR 2556CP	3.20
XR 2240CP	3.25

PHASE LOCKED LOOPS

XR 210	5.20
XR 215	6.60
XR 567CP	1.95
XR 2567CP	2.99

WAVEFORM GENERATORS

XR 205	$3.70
XR 2206CP	3.20
XR 2207CP	3.20

STEREO DECODERS

XR 1310P	8.40
XR 1310EP	4.49
XR 1800P	3.85

MISCELLANEOUS

XR 2211CP	6.70
XR 2261	3.79

DATA HANDBOOKS

7400	Pin-out & Description of 5400/7400 ICS	$2.95
CMOS	Pin-out & Description of 4000 Series ICS	$2.95
LINEAR	Pin-out & Functional Description	$2.95

ALL THREE HANDBOOKS $6.95

JAMES FEBRUARY SPECIALS

Astrisk Denotes Items On Special For This Month

Special Requested Items

RC4194	Dual Track V reg	$ 5.95	8T97	$ 3.00	MK5007 $10.95	MC4044	4.50
RC4195	+ 15V Track Reg	3.25	4024P	2.25	8083 5.95	LM3999	2.95
F8388	Decoder	3.95	2513	11.00	8367 2.75	MM5369	19.95
LD110/111	DVM Chip Set	29.00	2516	7.00	8798 1.15	74279	.90
CA3130	Super CMOS Op Amp	1.49	2524	3.50	8835 2.00	4072AE	.45
MC1408L7	A/D	9.95	2525	6.00	8869 1.35	4011AE	2.50
F3341	PIFO	9.95	2527	5.00	7497 5.00	4136	2.50

WE'LL BE HAPPY TO QUOTE ON YOUR SPECIAL PARTS --

OPTO ELECTRONICS

XCITON
LITRONIX
MONSANTO

DISCRETE LEDS

R - RED
G - GREEN
Y - YELLOW
O - ORANGE

.125" dia.

XC326R	5/$1	
XC326G	4/$1	
XC326Y	4/$1	
XC326O	4/$1	

.185" dia.

XC526R	5/$1	
XC526G	4/$1	
XC526Y	4/$1	
XC526O	4/$1	

.190" dia.

XC111R	5/$1	
XC111G	4/$1	
XC111Y	4/$1	
XC111O	4/$1	

.200" dia.

XC32R	5/$1	
XC32G	4/$1	
XC32Y	4/$1	
XC32O	4/$1	

.200" dia.

XC556R	5/$1	
XC556G	4/$1	
XC556Y	4/$1	
XC556O	4/$1	

.085" dia.

MV50		
088" dia. filtere		
red lens		
0/01		

DISPLAY LEDS

FND70 FND357 MAN1 MAN2 MAN3 MAN7 DL747 DL356

TYPE	POLARITY	HT		TYPE	POLARITY	HT	
MAN 1	COMMON ANODE	.270	$1.95	MAN 74	COMMON CATHODE	.300	$1.99
MAN 2	5 x 7 DOT MATRIX	.300	3.95	DL707	COMMON ANODE	.300	$1.50
MAN 3	COMMON CATHODE	.125	.30	DL747	COMMON ANODE*	.600	1.95
MAN 4	COMMON CATHODE	.187	2.50	DL750	COMMON CATHODE	.880	2.49
MAN 7	COMMON ANODE	.300	1.50	DL338	COMMON CATHODE	1.10	1.95
MAN 7G	COMMON ANODE-GREEN	.300	2.50	FND70	COMMON CATHODE	.250	.99
MAN 7Y	COMMON ANODE-YELLOW	.300	2.50	FND503	COMMON CATHODE	.500	1.75
MAN 72	COMMON ANODE	.300	1.50	FND567	COMMON ANODE	.500	1.75

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100		1-24	25-49	50-100
8 pin	$.17	.16	.15	24 pin	$.38	.37	.35
14 pin	.20	.19	.18	28 pin	.45	.44	.43
16 pin	.22	.21	.20	36 pin	.60	.59	.58
18 pin	.29	.28	.27	40 pin	.83	.82	.81
22 pin	.37	.36	.35				

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	.25	.24	28 pin	$ .99	.90	.81
16 pin	.28	.27	.25	36 pin	1.38	1.26	1.15
18 pin	.35	.32	.30	40 pin	1.53	1.45	1.30
24 pin	.49	.45	.42				

SOLDERTAIL STANDARD (GOLD)

8 pin	$.30	.27	.24	24 pin	$ .70	.63	.57
14 pin	.35	.32	.29	28 pin	1.10	1.00	.90
16 pin	.36	.35	.32	36 pin	1.75	1.40	1.25
				40 pin	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	.41	.37	24 pin	$1.05	.95	.85
14 pin	.39	.38	.37	28 pin	1.40	1.25	1.10
16 pin	.43	.42	.41	36 pin	1.59	1.45	1.30
18 pin	.70	.69	.62	40 pin	1.75	1.59	1.40

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM 27 OHM	12 OHM 33 OHM	15 OHM 39 OHM	18 OHM 47 OHM	22 OHM 56 OHM	1/4 WATT 5% - 50 PCS.	
ASST. 2	5 ea.	68 OHM 180 OHM	82 OHM 220 OHM	100 OHM 270 OHM	120 OHM 330 OHM	150 OHM 390 OHM	1/4 WATT 5% - 50 PCS.	
ASST. 3	5 ea.	470 OHM 1.2K	560 OHM 1.5K	680 OHM 1.8K	820 OHM 2.2K	1K 2.7K	1/4 WATT 5% - 50 PCS.	
ASST. 4	5 ea.	3.3K 8.2K	3.9K 10K	4.7K 12K	5.6K 15K	6.8K 18K	1/4 WATT 5% - 50 PCS.	
ASST. 5	5 ea.	22K 56K	27K 68K	33K 82K	39K 100K	47K 120K	1/4 WATT 5% - 50 PCS.	
ASST. 6	5 ea.	150K 390K	180K 470K	220K 560K	270K 680K	330K 820K	1/4 WATT 5% - 50 PCS.	
ASST. 7	5 ea.	1M 2.7M	1.2M 3.3M	1.5M 3.9M	1.8M 4.7M	2.2M 5.6M	1/4 WATT 5% - 50PCS.	

ALL OTHER RESISTORS FROM 2.2 OHMS 5.6M AVAILABLE IN MULTIPLES OF 5 ea.
5-25 PCS: .08 ea. 30-95 PCS: .04 ea. 100-495 PCS: .03 ea. 500-995 .027 ea.

14 PCS. POTENTIOMETER ASSORTMENTS

ASST. A 2 ea. 10 OHM 20 OHM 50 OHM 100 OHM 200 OHM 250 OHM 500 OHM
ASST. B 2 ea. 1K, 2K 2.5K, 10K, 20K, 25K, 50K
ASST. C 2 ea. 50K, 100K, 200K, 250K, 500K, 1M, 2M

$9.95 Per Asst.

Each assortment contains 14 pcs of 10 turn pots. All pots are available in single unit quantities. $.99 ea.

PRIME INTEGRATED CIRCUIT ASSORTMENTS

ASST. A	7 ea.	SN7400	7401	7402	7403	7404	555 TYP.		$5.95 ASST.
		SN7410	7420	7430	7440	7472			
ASST. C	7 ea.	SN7441	7490	7451	74100	74121	MFG. TYP.		$9.95 ASST.
		SN74155	74175	74180	74181	74193			
ASST. 10	2 ea.	CD4001	4002	4011	4012	4013	CMOS		$4.95 ASST.
		CD4016	4017	4019	4021	4023			
ASST. 11	2 ea.	LM301	3015	3021	3077	3900	LINEAR		$10.95 ASST.
		LM311	3053	3677	7811	7815			

Satisfaction Guaranteed, $5.00 Min. Order. U.S. Funds.
California Residents — Add 6% Sales Tax
Write for FREE 1976 Catalog — Data Sheets .25¢ each

JAMES

P.O. BOX 822, BELMONT, CA. 94002

PHONE ORDERS — (415) 592-8097

74LS00 TTL

74LS00	.39	74LS85	.89	74LS151	1.55
74LS02	.39	74LS73	.65	74LS153	1.99
74LS03	.39	74LS74	.65	74LS157	1.55
74LS04	.45	74LS75	.79	74LS162	2.25
74LS05	.45	74LS76	.65	74LS163	2.25
74LS08	.39	74LS83	2.19	74LS164	2.25
74LS10	.39	74LS86	.65	74LS181	3.89
74LS13	.79	74LS90	1.25	74LS190	2.95
74LS14	2.19	74LS92	1.25	74LS191	2.95
74LS20	.39	74LS93	1.25	74LS192	2.95
74LS26	.40	74LS95	2.19	74LS193	2.95
74LS27	.45	74LS96	1.89	74LS194	2.25
74LS30	.49	74LS107	.65	74LS195	2.25
74LS32	.39	74LS112	.65	74LS257	1.89
74LS37	.65	74LS122	1.95	74LS260	.99
74LS40	.49	74LS136	.65	74LS279	.79
74LS51	.39	74LS139	1.99	74LS670	5.95

DPST
C & K ROCKER SWITCH
Dim: 1" x 1" x ½"

They are rated at 125 Vac @ 5A. They are excellent in applications such as Microcomputer Panel Switches. **$.69**

DPST								
			AMT	1	2-9	10-24	25-99
	ON	OFF	ON	201	3.05	2.65	1.97	1.78
	ON	NONE	ON	203	3.05	2.35	1.68	1.51
	ON	OFF	ON	101	2.25	1.95	1.43	1.30
	ON	NONE	ON	103	2.05	1.85	1.31	1.19

MINIATURE TOGGLE

SPDT — SERIES MS, MSI

	Model Number	1 Each	Quantity and prices Each 2-9	10-19	20-99
Maintained Action Switch: Push To Make Contact. And Push Again To Break or Action	PB-123	$2.35	$1.95	$1.47	$1.30
Momentary Action Switch: Normally Open or Normally Closed. (For N.C. circuit use terminals 2 & 1, for N.O. 2 & 3) for N.C. and N.O. 1,2,3)	PB-130	$2.35	$1.95	$1.47	$1.30

PUSH BUTTON

THUMBWHEEL SWITCHES

Part No.	Description	Price
SF EP	End Plate (Pair)	$.50
SF DP	Divider Plate (each)	.40
SF BB	Blank Body (each)	.40
SF HB	Half Body (each)	.40

Part No.	Description	Price
SR EP	End Plates (pair)	$.50
SR DP	Divider Plate (each)	.40
SR BB	Blank Body (each)	.40
SR HB	Half Body (each)	.40

8 POSITION ROTARY SWITCH

These switches are a 7 position, one position open, rotary switch enclosed in a 10-5 can. They have a standard 8 pin configuration and will mount perfectly on printed circuit board. **$.99 ea.**

ZENERS—DIODES—RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400m	4 1.00	IN4003	200 PIV	1 AMP	12/1.00
1N751	5.1	400m	4 1.00	IN4004	400 PIV	1 AMP	12/1.00
1N752	5.6	400m	4 1.00	IN3600	50	50m	10/1.00
1N753	6.2	400m	4 1.00	IN4148	75	10m	15/1.00
1N754	6.8	400m	4 1.00	IN4154	35	10m	12/1.00
IN5257	3.3	500m	20	IN4734	5.6	1w	20
IN5259	5.6	500m	20	IN4735	6.2	1w	20
IN5261	6.2	500m	20	IN4735	6.8	1w	20
IN5235	6.8	500m	20	IN4738	8.2	1w	20
IN5236	7.5	500m	20	IN4742	12	1w	20
IN456	25	40m	6 1.00	IN4744	15	1w	20
IN4148	75	10m	6 1.00	IN5181	50 PIV	3½ AMP	1.40
IN4004	100	10m	5 1.00	IN1184	100 PIV	3½ AMP	1.70
IN4001	50 PIV	1 AMP	12/1.00	IN1186	200 PIV	3½ AMP	1.90
IN4007	100 PIV	1 AMP	12/1.00	IN1188	400 PIV	3½ AMP	2.00

TRANSISTORS

MPS A05	5 $1.00		PN3567	3 $1.00	PN4250	4 $1.00
MPS A06	5 $1.00		PN3568	4 $1.00	PN4250	4 $1.00
2N2221	3 $1.00		PN3569	4 $1.00	2N4401	4 $1.00
2N2221A	4 $1.00		2N3704	5 $1.00	2N4402	4 $1.00
2N2222	5 $1.00		2N3705	5 $1.00	2N4403	4 $1.00
2N2369A	4 $1.00		2N3706	5 $1.00	2N4409	5 $1.00
PN2415	5 $1.00		2N3707	5 $1.00	2N5086	4 $1.00
2N2484	4 $1.00		2N3711	5 $1.00	2N5087	4 $1.00
2N2906A	4 $1.00		2N3724	5 $.65	2N5088	4 $1.00
2N2907A	5 $1.00		2N3725	$1.00	2N5089	4 $1.00
2N2923	3 $1.00		2N3821	5 $1.00	2N5109	5 $1.00
2N3053	2 $1.00		2N3904	4 $1.00	2N5133	5 $1.00
2N3055	$1.00		2N3905	4 $1.00	2N5139	5 $1.00
MJE3055	$1.00		2N3906	4 $1.00	2N5210	5 $1.00
MJE2955	$1.25		2N4013	3 $1.00	2N5551	5 $1.00
2N3392	5 $1.00		2N4014	3 $1.00	C106B1TGCR	/ $1.00
2N3398	5 $1.00				2N5432	$2.00

CAPACITOR CORNER
50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100	1-9	10-49	50-100
10pf	05	04	02	001	05	04	025
22 pf	05	04	03	0047	05	04	025
47 pf	05	04	03	01	05	04	025
100 pf	05	04	03	022	05	04	04
270 pf	05	04	03	047	05	05	04
470 pf	05	05	035	1	12	09	07

100 VOLT MYLAR FILM CAPACITORS

001mf	12	10	07	022mf	13	11	09
0022	12	10	07	047mf	21	17	13
0047mf	12	10	07	1mf	27	23	17
01mf	12	10	07	22mf	33	27	22

+ 20% DIPPED TANTALUMS (SOLID) CAPACITORS

1	35V	70	23	17	15	25V	30	24	21
15	25V	70	23	17	2.2	25V	31	27	22
22	15V	70	23	17	3.3	25V	31	27	22
33	15V	70	23	17	4.7	25V	31	27	23
47	15V	70	23	17	6.8	25V	31	27	25
68	15V	70	23	17	10	25V	30	25	24
10	15V	70	23	17	15	25V	63	50	40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

Axial Lead					Radial Lead				
.47	50	15	11	10	.47	25	15	13	10
1	50	15	14	11	1.0	50	16	14	11
2.2	50	15	14	11	2	50	16	15	11
4.7	25	15	12	9	4	25	16	15	11
10	25	15	12	9	5	50	16	15	11
22	25	15	12	9	10	25	16	15	11
33	25	15	12	9	22	25	15	13	10
47	25	17	15	12	33	25	15	13	10
68	25	17	15	12	47	25	15	13	10
100	50	24	20	16	68	25	16	14	12
150	50	24	20	16	100	50	16	14	12
220	50	24	20	16	150	50	16	14	12
330	50	25	21	16	220	50	16	14	12
470	50	25	21	16	330	50	16	14	12
1000	50	25	21	16	470	50	16	14	12
2200	50	25	21	16	1000	50	16	14	12
3300	50	25	21	16	2200	50	16	14	12
4700	50	25	21	16	3300	50	16	14	12
6800	50	25	21	16	4700	50	16	14	12
10000	50	25	21	16	6800	50	16	14	12
15000	50	25	21	16	10000	50	16	14	12
22000	50	25	21	16	15000	50	16	14	12
33000	50	25	21	16	22000	50	16	14	12
47000	50	25	21	16	33000	50	16	14	12
68000	50	25	21	16	47000	50	16	14	12
100000	50	25	21	16	68000	50	16	14	12
150000	50	25	21	16	100000	50	16	14	12
220000	50	25	21	16	150000	50	16	14	12
330000	50	25	21	16	220000	50	16	14	12
470000	50	25	21	16	330000	50	16	14	12
680000	50	25	21	16	470000	50	16	14	12
1000000	50	25	21	16	680000	50	16	14	12
2200000	50	25	21	16	1000000	50	16	14	12

S. D. SALES CO.

6 Digit Digital Clock Kit

We wanted **our word** to mean something to **you**. When we first introduced our clock we used such words as "impossible", "unbelievable bargain", "prime quality", and "unconditional money back guarantee." We anticipated selling several hundred kits. Your response to our clock has been fantastic. Now several thousand kits later, we hear such comments as "outstanding value", "exceptional service", "I can't believe it", etc. One enthusiastic customer even wrote saying it was "the best thing since bottled beer."

Here's What The Kit Includes:

1 - MM5314 National Clock Chip with socket
6 - Common Cathode Led Readouts (.25 in. char.)
13 - NPN and PNP Driver Transistors
2 - Push Button Switches for time set
1 - Switch for Time Hold
1 - Filter Cap
4 - IN4001 Rectifiers
1 - IN914 Diode
2 - .01 Disc. Caps
9 - Carbon Resistors

$9.95 (KIT) WITH SPECS. POSTPAID

*Transformer $1.50

P.C. BOARD FOR ABOVE $3.00 each

INTEL 1702A 2K ERASEABLE PROM'S $6.95

We tell it like it is. We could have said these were factory new, but here is the straight scoop. We bought a load of new computer gear that contained a quantity of 1702A's in sockets. We carefully removed the parts, verified their quality, and are offering them on one heck of a deal. First come, first served. Satisfaction guaranteed.

PROFESSIONAL QUALITY STEREO HEADPHONES

Here is the kind of super deal that S. D. is famous for. Treat your ears to a super sound at a super price. Soft padded ear cushions, lightweight, fully adjustable headband, long coiled cord, wide response. **$6 Post Paid - NEW IN ORIGINAL FACTORY BOXES**

SALE ON CUT LEAD SEMICONDUCTORS

Leads were cut for PCB insertion. Still very useable. IN4148 Diode - 40/$1 2N3904 (House #Transistor) - 25/$1

INSTRUMENT KNOBS

Black with brushed aluminum insert. Medium size, very attractive style. **SPECIAL 5 FOR $1**

SIGNETICS 1K P-ROM

82S129. 256 X 4. Bipolar, much faster than MOS devices. 50 NS. Tri-state outputs. TTL compatible. Field programable, and features on chip address decoding. Perfect for microprogramming applications. 16 pin DIP. With specs. $2.95 ea.

TEXAS INSTRUMENTS 8 DIGIT CALCULATOR CHIP TMSO 103NC

Four function. Same style as used in TI pocket calculators. Factory new units, with specs. 99c each.

1AMP 1000 PIV SILICON RECTIFIERS

IN4007. Factory prime devices. 10 for $1.00

LM324 - QUAD 741 OP AMP - 99c

NE555 - Timers **2/$1.00**

709CH - OP AMPS - **5 for $1**

GE SCR C106B1

4 AMP 200PIV. Sensitive Gate. 59c

We Don't Sell Junk

741C OP AMPS

Prime, factory tested and marked. Full spec on all parameters. Not re-tested, functional only, units as sold by others.
741 CH -TO-5 8 Lead Metal Can . . . 3/$1
741CV - 8 Lead Mini Dip . . . . . 4/$1

DL747 JUMBO LED READOUTS

By Litronix. .65 inch character. Common anode. Outperforms SLA-3. perfect for giant digital clocks. Only 20 MA. per segment. Special - $2.50 ea. **(Not Class II)**

DUAL 741 (5558)

Another S.D. **"SPECIAL"** — 2 — 741V in one MINI DIP Package. These units were bought from Xerox Corporation on another of our super buys. They are house numbered, but guaranteed prime. They feature: No frenquency compensation required. Short circuit protection. Low power consumption. No latch-up.

S.D. SPECIAL INTRODUCTORY PRICE

4/$1.00

THE S.D.I.D. KIT

Need to know when ten minutes is up? The **S.D.I.D.** will tell you an be within .01% every time. Amateur radio operators asked us to develop and electronic 10 minute timer that would be accurate, so we put our heads together and, by golly, we have done it. Of course, if you are not an amateur, you could use it to time hard boiled eggs, baths, arguments, etc.

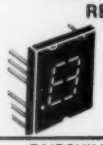
THE KIT INCLUDES:

1 — Ten Minute Timer Chip	**3 — Resistors**
4 — Rectifiers	**1 — L.E.D.**
3 — IN914	**2 — Push Button Switches**
1 — Filter Cap	**1 — Speaker**
2 — Disc Caps	**1 — Transformer**
3 — Transistors	**1 — P.C. Board**

All you need to furnish is a line cord and case. We know what you are thinking: "A kit that includes all of the above and is accurate to within .01% is bound to cost at least $5.95". You are so right — Don't let the price scare you. It is prime quality and guaranteed — With specs and postpaid.

$5.95

DO YOU NEED A LARGE COMMON ANODE READOUT AT A FANTASTIC PRICE !



S. D. presents the MAN-64 by Monsanto - .40 inch character. All LED construction - not reflective bar type, fits 14 pin DIP. Brand new and factory prime. Left D.P.
$1.59 ea. 6 for $7.50

FAIRCHILD LED READOUTS - 69c

FND-70. Common cathode. Right hand decimal point. .25 inch character. Prime new units. Perfect for clocks, frequency counters, etc. 69c 10 For $6

DRIVER TRANSISTORS
2N3904 - NPN
2N3906 - PNP
8 for $1

2102 1K RAM's - 8 FOR $12.95

New units by National. We bought a load on a super deal, hence this fantastic price.
Units tested for 500NS Speed.

FET'S BY TEXAS INSTRUMENTS

#TIS-75 but with an internal house number. TO-92 plastic case. N Channel, Junction type FET.
SPECIAL 5 FOR $1

FAIRCHILD BIG LED READOUTS

A big .50 inch easy to read character. Now available in either common anode or common cathode. Take your pick. Super low current drain, only 5 MA per segment typical.

FND - 510	Common Anode	**YOUR CHOICE**
FND - 503	Common Cathode	**$2 ea.**

H.P. IS BACK!

No Rejects or Retests here — You Want Quality? You have it with this popular 0.3" L.E.D. by Hewlett Packard. Fits Standard I.C. Socket. Right hand DP.
5082-7740 — Common Cathode $1.25
6 for $6.00

We do not sell junk. Money back guarantee on every item. WE PAY POSTAGE. Orders under $10 add 75c handling. No C.O.D. Texas Res. add 5% tax.

S. D. SALES CO.
P.O. BOX 28810
DALLAS, TEXAS 75228

Wow! INCREDIBLE PRICES Poly Paks

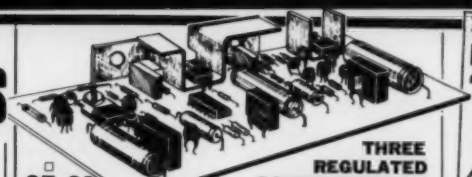
TTL'S

BUY ANY 10 TAKE 15%

☐ SN7400	$.16	☐ SN7462	$.22
☐ SN7401	.16	☐ SN7470	.29
☐ SN7402	.16	☐ SN7471	.49
☐ SN7403	.16	☐ SN7472	.29
☐ SN7404	.19	☐ SN7473	.36
☐ SN7405	.19	☐ SN7474	.36
☐ SN7406	.35	☐ SN7475	.59
☐ SN7407	.35	☐ SN7476	.39
☐ SN7408	.19	☐ SN7478	.79
☐ SN7409	.19	☐ SN7480	.52
☐ SN7410	.16	☐ SN7481	.99
☐ SN7411	.25	☐ SN7482	.89
☐ SN7413	.59	☐ SN7483	1.25
☐ SN7414	1.65	☐ SN7485	1.25
☐ SN7416	.34	☐ SN7486	.37
☐ SN7417	.34	☐ SN7488	3.95
☐ SN7420	.16	☐ SN7489	2.45
☐ SN7421	.45	☐ SN7490	.59
☐ SN7423	.29	☐ SN7491	1.10
☐ SN7425	.29	☐ SN7492	.59
☐ SN7426	.25	☐ SN7493	.59
☐ SN7427	.29	☐ SN7494	.95
☐ SN7430	.19	☐ SN7495	.79
☐ SN7432	.39	☐ SN7496	.79
☐ SN7433	.49	☐ SN74100	1.40
☐ SN7437	.34	☐ SN74104	.44
☐ SN7438	.34	☐ SN74105	.44
☐ SN7440	.16	☐ SN74106	.52
☐ SN7441	1.00	☐ SN74107	.44
☐ SN7442	.70	☐ SN74108	.89
☐ SN7444	1.25	☐ SN74112	.89
☐ SN7445	.89	☐ SN74113	.89
☐ SN7446	1.15	☐ SN74114	.89
☐ SN7447	.99	☐ SN74121	.49
☐ SN7448	.99	☐ SN74122	.48
☐ SN7450	.16	☐ SN74123	.85
☐ SN7451	.17	☐ SN74125	.59
☐ SN7452	.17	☐ SN74126	.59
☐ SN7453	.17	☐ SN74132	1.75
☐ SN7454	.17	☐ SN74140	2.10
☐ SN7455	.22	☐ SN74145	1.05
☐ SN7460	.17	☐ SN74200	4.95

BUY 100 TAKE 25%

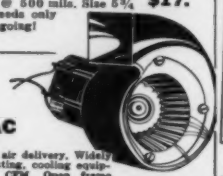
☐ SN74148	2.25
☐ SN74150	.98
☐ SN74151	.75
☐ SN74153	.90
☐ SN74154	1.35
☐ SN74155	.95
☐ SN74156	.95
☐ SN74157	.95
☐ SN74158	.95
☐ SN74160	1.35
☐ SN74161	1.25
☐ SN74163	1.35
☐ SN74164	1.50
☐ SN74165	1.50
☐ SN74166	1.50
☐ SN74173	1.45
☐ SN74174	1.39
☐ SN74175	1.30
☐ SN74176	1.20
☐ SN74177	1.20
☐ SN74180	.35
☐ SN74181	2.98
☐ SN74182	.74
☐ SN74184	1.98
☐ SN74185	1.98
☐ SN74190	1.40
☐ SN74191	1.40
☐ SN74192	1.25
☐ SN74193	1.25
☐ SN74194	1.20
☐ SN74195	.85
☐ SN74196	1.80
☐ SN74197	.90
☐ SN74199	1.75



☐ **$5.95** **THREE REGULATED POWER SUPPLIES ON A BOARD**

Each power supply rated at 500 mils. Neatly engineered and precision designed for either solder or edge connecting. IMAGINE! 2 of the power supplies' outputs have adjustable voltage controls. Uses the finest U.S. made parts with famous names as Motorola, Fairchild, RCA, etc. POWER SUPPLY #1 — 12V to 17VAC input, adjustable 9V to 17VDC @ 500 mils. POWER SUPPLY #2 — Same as #1. There it may be used as positive and negative or a dual unit. POWER SUPPLY #3 — 9VAC input, 5VDC output @ 500 mils. Size 5¼ x 3¾ x 1 (G-10) pc board. Needs only input transformers to get 'em going! Heavily heat-sinked! Wt. 6 oz.

☐ **3 for $17.**



ALLIANCE SHADE POLE BLOWER 115VAC

Offers maximum efficiency in quiet air delivery. Widely used in heating, ventilating, exhausting, cooling equipment. Direct drive motors 100 CFM. Open frame shaded pole motor, driving a Torrington 3½ x 3" bladed wheel, square 2¼ x 2" intake, 2½ outlet holes. Overall size of housing 4½ x 2½ x 5" deep. Wt. 2 lbs. 3 - 10/32 mtg. holes.

$4.95

POSTAGE STAMP MOBILE MIKE SPKR ☐ **$1.98**

This unit is not advertised — anywhere! Made for Motorola Communications at the original cost of $4.50 each (for insertion in their Walkie Talkie Program). It's a 60-ohm imp MIKE. It's an excellent speaker too, covering broad range in sound. Extremely well-made.

IT'S NEW! "TO-5" MICRO MINI 0-8 ROTARY SWITCH **$1.95** 3 for $5.

IMAGINE! 8 DIFFERENT ROTARY CIRCUITS IN 1/4 x 5/16" Space

- TO-5 Transistor Case!
- Screwdriver Adjust!
- 8 Separate Positions!
- 1/4 x 5/16" Space Saver!

We introduced our customers to "7 Switches On A DIP", and now . . . for the 1st time anywhere A MICRO-MINIATURE ROTARY SWITCH shaped like a TO-5 transistor case. That's right! . . . TO-5 case! Imagine 8 different rotary circuits in 1/4 x 5/16" space (a true space saver). 8 pins gold plated! Use for P.C. Features 0-to-9, 45° angle, 0.05" screwdriver adjust shaft on top of case, breakdown voltage 500, 1/2-Meg. insulation resistance. By CHICAGO SWITCH, Type 30-8-08-005. It's the most unusual switch for micro-circuit use.

NATIONAL LM-340T VR's

- TO-220 Case • 1 Amp
- POSITIVE VOLTAGE

$1.50 Each 3 for $3.

Type	Volts
LM-340-05T	5 v
LM-340-06T	6 v
LM-340-08T	8 v
LM-340-12T12	v
LM-340-15T15	v
LM-340-18T18	v
LM-340-24T24	v

"BLASTAWAY" ON 1N4000 RECTIFIER PRICES

Type	PIV	Sale
☐ 1N4001	50	10 for 45c
☐ 1N4002	100	10 for 55c
☐ 1N4003	200	10 for 65c
☐ 1N4004	400	10 for 75c
☐ 1N4005	600	10 for 85c
☐ 1N4006	800	10 for 99c
☐ 1N4007	1000	10 for 1.29

INDUSTRIAL SPEED CONTROL ☐ **$4.95**

A $30 item from G.E. Model 533A (made for Xerox) that controls home, shop and industrial lighting too! A very elaborate circuit for controlling many electrical and electronic devices. Easily controls speeds of electric drills, brush type motors, etc. 115vac, rated at 1100 watts. With variable speed or dimming control in heavy-duty aluminum case. 3 x 2¾ x 2. With diagram and hookups.

PROGRAMMABLE TIMER DELAYS UP TO 5 DAYS

XR-2240 14-pin DIP Consists of a self-contained 8-bit programmable binary counter, oscillator, and controlled flip-flop. 4V to 15V supply. Temp. and power supply stability outperforms all others. Power only 12 mW. @ 4V. Programmable capability 256 steps. 8 separate outputs, one for each counter.

☐ **$4.95**

"BEEPER" AND "DATER" CLOCK ON THE CHIPS

☐ MK50250 BEEPER

$6.95

Imagine a chip (MK50250) "Beepin" and audible alarm! All others are external. It also features internal brightness control. The CT7001 requires external triggering of alarm, date of the month and direct drive to LED readouts. Both require minimum current drain and voltages, for either 4 to 6 LED readouts, 12 or 24 hours, AM and PM.

☐ CT7001 Alarm and Date . . . $8.88

MICROPROCESSORS! ROMS! RAMS! MEMORIES!

☐ 8008 Microprocessor	$19.95
☐ 8080 Super 8008	100.00
☐ 2102 1024 Static RAM	3.50
☐ 1101 256 bit RAM	1.50
☐ 1103 1024 bit RAM	2.95
☐ MM5260 1024 RAM	1.95
☐ MM5262 2048 bit RAM	3.95
☐ 2513 Character generator	12.50
☐ MM5203Q Eraceable PROM	12.50
☐ MM5202Q Eraceable PROM	9.95
☐ 1702A Eraceable PROM	12.50
☐ 8223 Programmable ROM	2.95

TELE TYPE CHIPS			
	☐ COM2502	UART, 40 pin	$12.50
	☐ COM2601	USRT, 40 pin	24.00
	☐ KR-2376ST	Keyboard encoder ROM	12.50
	☐ NMX-3010	10 channel multiplex	9.95

SPECTROL TYPE 43 RECTANGULAR CERMET POTS

Ohms	Ohms	Ohms
☐ 10	☐ 1K	☐ 100K
☐ 20	☐ 2K	☐ 200K
☐ 50	☐ 5K	☐ 250K
☐ 100	☐ 10K	☐ 500K
☐ 200	☐ 20K	☐ 1 Meg
☐ 500	☐ 50K	☐ 2 Meg

2 for $1.00 ☐

Cermet sealed. Screw driver adjust with idling and stops. Resistance ±10 percent. ⅝ watt. Size .750 x .25 x .19.

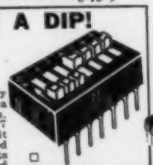
Touch Tone **KEYBOARD KIT** ☐ **$4.95**

Kit includes 4 x 2½" G-10 glass etched pc board, with 10 OAK "smooth touch" white keys with black numerals, plus diagram on "touch tone encoder". Makes many "keyboard systems" readily available. *0-to-9*

IMAGINE! 7 SWITCHES ON A DIP!

- *Tease Resistant Over-Center Switching Action!*
- *Positive Detent For Tactile Feel!*
- *Dust Resistant Construction!*
- *Low Profile—0.3" Max. Height Above P.C*

Poly Paks exclusive DIP SWITCHES. Provides highly reliable, low-cost means of manually programming a variety of micro-miniature electrical-electronic circuits. Each device rocker actuated, SPST. High reliability. 7 different circuits on a DIP IC type housing mat'ls it ECONOMICAL. Housing of heat-resistant glass-filled nylon material. Fits into 14-pin IC socket, or its phosphor bronze gold-plated connections for PC board use too! Each switch rated at (non-switching) 50 VDC @ 100 ma. Meets MIL specs. Size ¾ x ⅝ x ⅛".



☐ **$2.50** 3 for $6.

MAGNACRAFT **REED RELAY IN A DIP PACK**

Class 171DIP

$2.50 3 for $6

One of the special outstanding new buys of 1976 for you hobbyists looking for something different in relays. Designed so that you can insert in standard 14-pin IC socket. Rated at 5 volts @ 150 ohm coil, SPST NC contacts. Designed to work with integrated circuits. Max. IC rating 100 mils, breakdown voltage 100 VDC. Needs 1 volt to break circuit. With built-in coil suppression diode.

G.E. DYNAMIC MIKE

Crystal clear response for all types of ham, audio sept. Size only 3¼ x 1½ x ⅞". Gray impact case. ON-OFF switch. With multi position stand. 6-ft. of cable for plug and external switch control. 50K ohms imp. 60 to 9000 hz. Wt. 6 ozs.

☐ **$2.50** 3 for $6.00

CLOCK CHIPS ON A "DIP"

☐	MM5311	6-digit 28-Pin	$6.50
☐	MM5312	6-digit 24-Pin	5.50
☐	MM5313	6-digit 28-Pin	5.50
☐	MM5314	6-digit 24-Pin	5.50
☐	MM5316	4-digit 40-Pin, alarm	5.50
WITH DATA SHEETS	☐	MM5316-A no alarm	3.95

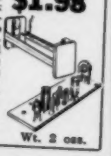
THE MYSTERY BONANZA OF THE YEAR! YOU CAN'T LOSE!

ELECTRONIC "WUT-IZ-IT"

3 for $5.

Could be a gadgeteer's parts bonanza (or a gadgeteer's dream). Here's what you get: Mounted in a plastic transistor radio size (3 x 2 x 1½") case is a 2-transistor amplifier attached to a 1¾" diameter PM speaker (excellent for digital beeper clocks). ALSO has a push-push switch, it's powered by an AA battery (not included) in a battery holder. Gadgeteers . . . can you guess? We can't! At this price when you buy the parts alone you can't lose

☐ **$1.98**



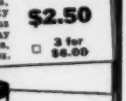
Wt. 2 ozs.

OMNI-DIRECTIONAL MIKE-SPEAKER

Imagine only 1⅛ x ⅛". This unusual spiral "space like" capsule with plastic protective cover. Sound travels in any direction. Mike or as speaker. Acoustically one of the highest quality units for many hi-fi, digital & experimental uses. As mike it is high impedance. 20K ohms. As a speaker, finest "beeper" units for digital clocks, whereby the tonal quality is a pure loud tone minus the raspy sounds you may get with standard speakers. With 2-wire leads. 2-Oz.

$2.50

☐ 3 for $6.00



CODE
State 1st, 2nd, 3rd Choices of Case Styles
•State Voltages 5 thru 24
(D) = Dual; (Q) = Quads

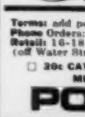
Buy 3 — Take 10%

RAYTHEON-RCA NATIONAL SIGNETICS LINEAR IC'S

☐ LM300	$ .69	☐ LM562	1.95
☐ LM301	.29	☐ LM565	1.95
☐ LM304	.79	☐ LM566	1.95
☐ LM308	1.95	☐ LM567	1.95
☐ LM309H	1.05	☐ LM702	.49
☐ LM309K	1.50	☐ LM703	.41
☐ LM311	.99	☐ LM703N	.41
☐ LM318	1.75	☐ LM709	.25
☐ LM319	1.19	☐ LM710	.29
☐ LM320*	1.25	☐ LM711	.29
☐ LM322	1.75	☐ LM723	.61
☐ LM324 (Q)	1.85	☐ LM733	1.75
☐ LM339 (Q)	1.45	☐ LM741	.31
☐ LM340*	2.50	☐ LM741CV	.31
☐ LM350	.69	☐ LM747 (D)	.69
☐ LM370	1.05	☐ LM748	.35
☐ LM373	1.95	☐ LM1458 (D)	.69
☐ LM374	1.95	☐ LM1800	3.50
☐ LM376	.49	☐ CA3026	.59
☐ LM377	2.50	☐ CA3045	.59
☐ LM380-8	1.10	☐ CA3054	.59
☐ LM380	1.39	☐ CA3052	.59
☐ LM381	1.69	☐ LM3900	.49
☐ LM382	1.69	☐ RC4195	2.50
☐ LM531	1.95	☐ LM4250C	2.10
☐ LM532	1.95		
☐ LM535	.89		
☐ LM536	2.80		
☐ LM558 (D)	.69		
☐ LM560	1.95		
☐ LM561	1.95		

LED Revolution! **5 for $1**

MONSANTO! XCITON! LITRONIX! OPCOA!



.340x.260 Jumbo	.240x.200 Medium
☐ Red	☐ Red
☐ Green	☐ Yellow
☐ Yellow	☐ Green
☐ Amber	☐ Amber
☐ Clear	☐ Clear

Micro	.210x.125
☐ Red	☐ Yellow
☐ Green	☐ Amber

Micro (Axial) MV-50 style
☐ MV-50 Clear . . . . 10 for $1.
☐ MV-55 Red . . . . . 6 for $1.

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EDITORIAL BY WAYNE GREEN

from page 17

The general rejoicing was cut short when we started to come back to a W9 which had been calling, only to see the Bird wattmeter drop off rapidly to zilch . . . followed by a little curl of smoke from the TPL amplifier. Well, thank heavens we'd made one contact before Murphy took over, zapping the most expensive and hard to replace part of the system.

Oscarites . . . we shall return.

OH PIONEER!

Many of us reflect, as we drive along listening to the idle chatter coming through the repeater, that radio amateurs have been outstanding in their pioneering work . . . and we wonder how we might be able to do something of value. It's a little depressing to think of being up against a professional laboratory or a well-funded government grant project, but the fact is that there are many areas where we have a decided advantage.

An article in the December issue of *Modern Photography* pointed out how much work there is to be done in the field of Kirlian photography . . . a sort of electronic photography discovered by Semyon and Valentina Kirlian in the Soviet Union. There was quite a bit about this in the pocket book *Psychic Discoveries Behind the Iron Curtain.* The pictures are made by using a low current supply, around 10,000 volts, and putting the film and subject between two plates with this voltage on them . . . exposure around two to six seconds. What results appears to be tied in somewhat with the human aura, plus some other impossible-to-explain effects.

A Kirlian photograph of a leaf, part of which had been cut away, still showed the complete leaf! Bright points of light appear on photos of hands and these appear to be concentrated at the same points used by acupuncture!

This is a new field to research, is relatively inexpensive, and would seem ideally suited to many radio amateurs who have the needed combination of electronic and photographic experience.

Another area ripe for the lone individual, and not requiring a lot of lab equipment, is the development of computer programs for the new microprocessors . . . the major weak link in the growth of computers today. The writing of complex computer programs is necessarily the work of an individual, and the time required is of an order that greatly restricts commercial companies from just paying someone to do the job.

While an amateur radio set is ready to use when you plug it in and turn it on, like just about every other electronic device with which we are familiar . . . not so the computer. Your not inexpensive microcomputer will just sit there and not do a dammed thing when you plug it in and turn it on . . . unless you have some programming to get it going. Newer systems such as the 6800 series computers have a ROM included which has the programs on it to get the system up and running, but the 8080-based systems don't . . . as yet.

As of this date, to the best of my knowledge, none of the microprocessors have anything much more than Basic language ready to use. The Altair Extended Basic is being worked on and should be ready before long, but it's taken a lot longer than anyone thought it would to get the bugs out of it. Also, as far as I know, none of the systems are yet ready to use floppy disks, mag tape, or even cassette tape for much more than program entry. All of these things call for programs to be written . . . and that means a lot of time and work. This also means that there is a very wide open opportunity for some people to contribute substantially to the progress of microcomputers.

READER SERVICE

Now look here, good buddies, I don't want to come off as a scold, but the reader service department has been griping something fierce to me that there are several readers who have not been holding up their end of things . . . that they haven't been sending in their reader service requests. Mary, who takes care of that department, has those great big liquid brown eyes and if you could see the tears well up in them when she runs out of labels to send our advertisers you would run, not walk to your mail box and send in for some of her loving care.

Yes, I know you don't want to rip up the magazine, and you don't have to . . . if you don't have a copier handy then just make a note of the advertisers or the numbers of them on a card or shred of paper and send it in to Mary . . . she's a lovely person. Please don't be callous and cruel and forget our Mary.

Look, just because you ask for information doesn't mean you *have* to buy something . . . at least not from every advertiser.

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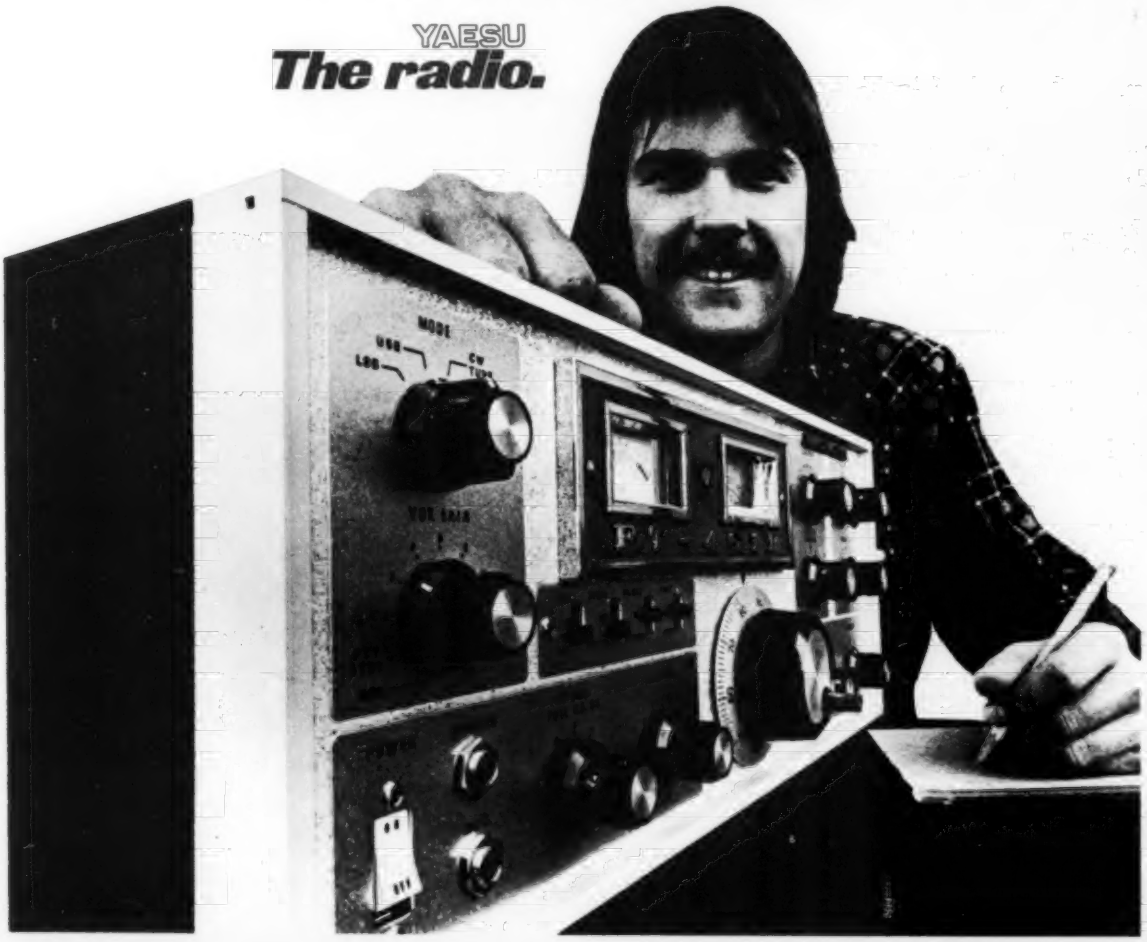

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